HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Spring Creek NFH: Tule Fall Chinook Program
Species or Hatchery Stock:	Tule Fall Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	U.S. Fish and Wildlife Service
Watershed and Region:	Mainstem Columbia River (WRIA 29)
Date Submitted:	10/07/2002
Date Last Updated:	10/04/2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

US Fish and Wildlife Service
Spring Creek National Fish Hatchery
Tule fall Chinook production program

1.2) Species and population (or stock) under propagation, and ESA status.

Tule fall Chinook (*Oncorhynchus tshawytscha*) are the propagation species. The Lower Columbia Fall Chinook have a Threatened Status under the ESA. The hatchery component of Columbia Fall Chinook is considered part of the ESU but is not essential for recovery.

1.3) Responsible organization and individuals

Name (and title): Rich Johnson, Asst. Fisheries Supervisor
Agency or Tribe: U.S. Fish and Wildlife Service
Address: Region 1 Fishery Resources Office
Eastside Federal Complex
911 NE 11th Ave.
Portland, OR 97232-4181
Telephone: (503) 872-2763
Fax: (503) 231-2062
Email: Rich_Johnson@fws.gov

Name (and title): Edward LaMotte, Hatchery Manager
Agency or Tribe: U.S. Fish and Wildlife Service
Address: Spring Creek National Fish Hatchery
61552 State Route 14
Underwood, WA 98651
Telephone: (509) 493-1730
Fax: (509) 493-2989
Email: Ed_Lamotte@fws.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

National Marine Fisheries Service (NOAA Fisheries funding and ESA) and U.S. Army Corps. Of Engineers provide funding for Spring Creek National Fish Hatchery and Washington Department of Fish and Wildlife (WDFW) and the Yakama Nation are co-managers.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding for the project is provided through the Mitchell Act (administered by National Marine Fisheries Service) and the Flood Control Act of 1950 (administered by U.S. Army Corp of Engineers). At full staffing level, the hatchery has 13 full time employees, and operates on an annual budget of approximately $800,000 (excluding overhead costs).

1.5) Location(s) of hatchery and associated facilities.

Spring Creek National Fish Hatchery is located in Skamania County, near the communities of Underwood and White Salmon, WA. The hatchery is bordered by the Columbia River (WRIA 29) at river kilometer 269.

1.6) Type of program.

Isolated Harvest Program: Mitigation

1.7) Purpose (Goal) of program.

The purpose of the tule fall Chinook program at Spring Creek National Fish Hatchery (SCNFH) is to mitigate for lost and degraded habitat and fish populations caused by the construction and operation of the Columbia River hydrosystem by producing locally adapted broodstock for sport, commercial, tribal, and international harvest. SCNFH was remodeled in 1955 under Mitchell Act authorization as part of the Columbia River Fisheries Development Program. In 1970, the Army Corps of Engineers razed and remodeled most of the facility to mitigate for fishery losses caused by construction of the John Day Dam. The Spring Creek tule fall Chinook brood stock originated from the White Salmon River, a mile from the location of the hatchery, and is the stock of choice for reintroduction in the White Salmon River pending Condit Dam removal scheduled in 2006.

1.8) Justification for the program.

Spring Creek National Fish Hatchery will provide fish for harvest by continued mitigative production of tule fall Chinook while maintaining fish cultural practices outlined in later sections of this document and in Spring Creek NFH Five-Year Production Plan Goals and Standards (2000). Spring Creek NFH fish cultural practices reflect the importance of monitoring fish health and eliminating fish stress while minimizing adverse effects on listed species. Tule fall Chinook will be propagated with appropriate fish culture methods that are consistent with the U.S. Fish Health Policy and Implementation, 713 FW (US Fish and Wildlife Service, 1995) and the "Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries" (Integrated Hatchery Operations Team, 1995).

Two distinct factors contribute to SCNFH minimizing adverse effects on listed fish species; present fishery harvest design and the release of hatchery smolts that are physiologically ready to migrate. The lower Columbia River Chinook ESU escapes significant mainstem harvest rate impacts in the lower river due to the current design of the fishery. A small population of the naturally spawning lower Columbia River Chinook ESU occurs above Bonneville Dam. This population presumably experiences a higher harvest rate in tribal fisheries than the populations below Bonneville Dam. The potential for higher harvest rates on a couple of the small tributary populations above Bonneville Dam, believed to be largely supported by locally spawning Spring Creek NFH tule fall Chinook, is not expected to have a significant impact on the overall ESU. Because harvest rate jeopardy standards for Snake River fall Chinook dictate the management of both ocean and in-river fisheries under a weak-stock management approach, harvest of Spring Creek fall Chinook program fish is not expected to have a significant impact on listed species. The 1999 fall-season harvest biological opinion determined that fisheries did not jeopardize any listed species (NMFS 1999c).

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions, as they should quickly migrate from the release site. Spring Creek fish are released directly into the mainstem Columbia River migration corridor rather than into tributary spawning or rearing areas. Based on Bonneville Dam sampling of juveniles, Spring Creek fish appear to emigrate rapidly, reducing the potential for competitive interaction with listed fish. Because Spring Creek NFH releases occur “low” in the system relative to many other upriver programs, and the emigration through the migration corridor appears to be rapid, there is reduced opportunity for competitive interactions. In addition, the three-release strategy also should reduce potential competitive interactions (see section 10.4 and 10.10).

1.9) List of program “Performance Standards”.

See Section 1.10

1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
1) Program contributes to mitigation requirements	Broodstock goal: Total 7,000, female return 4,000	Compare annual tule adult Chinook returns with hatchery goal. See sections 1.12 and 7.4.2 for detailed recent annual adult return numbers.
	Hatchery release goal: 15.1 million as outlined in NMFS Biological Opinion 1999- 7.6 million ≤ 125/lb size 4.2 million ≤ 90/lb size 3.3 million ≤ 60/lb size	Compare annual tule Chinook smolt hatchery releases with hatchery goals. See section 1.12 for detailed recent annual smolt release numbers.
	Smolt release to adult return Goal ≥ 0.5%	Compare annual tule Chinook survival rates with hatchery goal.
2) Implement spawning and rearing practices to achieve production goal.	Escapement goal: >7,000 adults of which 4,000 are female.	During spawning, adults are counted 16 hrs. a day by hatchery staff as an estimation, and total number of returning and spawned adults is accurately attained though surplus and spawning operations. Return data is entered into the Columbia River Information System or CRiS (Stephen M. Pastor, August 2002) and can be found on the annual run summary and spawning report.
	Adult pre-spawning survival goal ≥ 90%. Pre-spawning mortality (dead-in-ponds or DIPs) ≤ 5.0% of annual run Female DIPs ≤ 2.0% of annual run.	Ponds are checked a minim of once daily, for DIPs and the number is recorded and stored in CRiS. Total number of DIPs is presented in the annual run and spawning report.
	Egg-take goal ≥ 17.8 million, 20.8 million for years with unfed fry release.	Number is enumerated during the salting and shocking process and is based on weighted samples and extrapolated out to the weight of all eggs collected. Egg-take data is calculated and input into CRiS and can be found in annual summary and spawning report.
	Release 15.1 million tule fall Chinook smolts.	Enumerate fish releases and attain sufficient size at release so smoltification occurs through entire hatchery population (see section 1.11.1, 10.4, 10.10 for description).

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
2) Implement spawning and rearing practices to achieve production goal (continued).	Percent Survival Hatchery Goals: ≥ 95% egg to eye-up ≥ 90% egg to fry survival ≥ 97% fry to smolt survival ≥ 0.5% total survival (return to hatchery and caught in fishery)	Survival percentages from egg to eye-up, egg to fry, and fry to smolt survival are conducted by Spring Creek NFH staff during rearing and prior to release using sample counts and standard measuring techniques. Total survival of tule Chinook in addition to numbers of fish caught by fishery are estimated by personnel within the Columbia River Fisheries Program Office using tag return data from the Regional Mark Information System and information within CRiS.
3) Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.	Collection of adults throughout entire run	Systematic random sampling of returning adults throughout egg-take dates will insure spawning is representative of run.
	Spawning population >500	Number of spawned fish will be monitored.
	Male: Female spawning ratio. Goal: ≤ 2:1, whenever possible 1:1.	Sex and number of spawned fish will be enumerated.
	≥ 2.0% of males used in spawning process are jacks (age 2)	Number of adult tule Chinook classified as jacks will be enumerated.
4) Communicate effectively with other salmon producers and co-managers.	Check hatchery records for completeness	Hatchery record keeping data will be forwarded to CRiS., a searchable database system of pertinent hatchery information, for analysis.
	Develop and review past, current, and future Equilibrium Brood Documents (Washington Department of Fish and Wildlife requirement)	
	Hatchery Evaluation Team (HET) quarterly meetings.	As outlined in summary of U.S. v. Oregon and Columbia River Fish management Plan (1988) and by Production Advisory Committee to coordinate production through U.S. v. Oregon forums.

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
5) Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in U.S. v. Oregon.	Number of fish harvested in tribal fisheries targeting this program. Hatchery goal: "sufficient number of BPH fall Chinook pass Bonneville Dam to meet hatchery needs without disturbing traditional treaty Indian fish patterns in Bonneville Pool" (Summary U.S. v. Oregon and the Columbia River Fish Management Plan 1988)	Annual estimates of harvest are produced from data compiled in CRiS. In addition, the Joint Staff Report Concerning the Fall In-River Commercial Harvest of Columbia river Fall Chinook Salmon, summer Steelhead, Coho Salmon, Chum Salmon, and Sturgeon produced by the Joint Columbia River Management Staff annually details past and future harvest of Spring Creek NFH tule Fall Chinook, referred to as Bonneville Pool Hatchery (BPH).
	Proportion of harvestable return taken in tribal fisheries, by fishery.	Information of specific Tribal harvest by fishery is not immediately available through USFWS tag recovery information. Overall tribal harvest is grouped into the category "Columbia River Gillnet" presented in section 3.3.1. The adult escapement goal for Spring Creek NFH was achieved annually from 1970-84, 1991-92, 1994-1997, and 1999, which would have fulfilled U.S. v. Oregon requirements for tribal fisheries.
6) Fish produced for harvest are produced in a manner enabling effective harvest, as described in all applicable fisheries management plans.	Annual number of fish produced by this program caught in all fisheries, including estimates of fish released.	From annual coded wire tag recoveries and information provided to CRiS, annual reports are produced on number of tule fall Chinook harvested by brood year. Reports of annual estimated harvest by fishery are attached in section 13 for brood years 1980-1995 and are also presented in a table format in section 3.3.1.

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
7) Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Temporal distribution of broodstock collection.	Spring Creek NFH protocol is to select brood fish randomly throughout the spawning run (late August through early October). During spawning, adults are counted 16 hours a day by hatchery staff as an estimation, and total number of returning and spawned adults is accurately attained though surplus and spawning operations. Return data is entered into CRiS and can be found on a an annual run summary and spawning report.
	Age composition of broodstock collected.	Through coded wire tag recoveries collected from hatchery and USFWS personnel, proportions of each age class of returning adult tule Chinook is documented and input into CRiS data management. Broodstock age collection is random and representative of adult fish returning to hatchery.

Risks **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
1. Minimize interactions with other fish populations through proper rearing and release strategies.	Smolt size at release goals: March ≤ 125 fish/lb. April ≤ 90 fish/lb. May ≤ 60 fish/lb.	Size is monitored with using sample counts, which are performed bi-monthly. During March release, and coinciding with an approval of increased spill at Bonneville Dam, physical monitoring of total dissolved gas (TDG) at several sites below Bonneville Dam and in the mainstem Columbia River, in addition to physical examinations of fish below Bonneville Dam, will be conducted to provide information and real-time modifications to the proposed operation if the requested variance in criteria is exceeded. See section 10.4 for more information on increased spill at Bonneville Dam during March releases.
2. Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow USFWS Fish Health Policy and Implementation guidelines, the Integrated Hatchery Operation Team (IHOT) policy and the Salmon Disease Control Policy of the Fisheries Co-Managers of Washington State.	Necropsies of fish to assess health, nutritional status, and culture conditions.	Healthy and moribund juvenile fish are examined at least monthly by fish health specialists from the Lower Columbia River Fish Health Center (LCRFHC). Fish health specialists examine affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures. Therapeutic and prophylactic treatments are administered as necessary.
	Release and/or transfer exams.	Three to 6 weeks prior to transfer or release, 60 fish per lot are examined in accordance to the USFWS and co-managers policies.
	Inspection of adult broodstock.	At spawning, a minimum of 150 female and 60 male broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to the USFWS and co-managers policies.
	Applied research on new and existing techniques.	Evaluate new and existing procedures for effects on health, disease control and prevention.

Risks Performance Standards	Performance Indicators	Monitoring and Evaluation
2. Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens (continued).	Use sanitation procedures which prevent introduction of pathogens within a facility.	Formalin (37% formaldehyde) is dispensed into water for the control of fungus on eggs and the control of parasites on juveniles and adult salmon. Treatment dosage and time of exposure depends on life-stage and condition being treated. All eggs brought to the facility are surface-disinfected with iodophor between different fish/egg lots. Tank trucks or tagging trailers are disinfected when brought onto the station. Footbaths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens. At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each species.
	Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress, which can induce infectious and noninfectious diseases. Hatchery Density Index Goal: ≤0.3 Hatchery Flow Index Goal: ≤1.5	Density index data can be found on all inventory sheets and is used to calculate feed and mortality levels. The highest density index is observed just before the March release and split of the April and May release fish. Density index is calculated as (lbs. of fish) / (ft^3 rearing space) x (fish length in inches). Density index is catalogued during two-week intervals coinciding with feeding periods. Flow index is calculated as (lbs fish in pond) / (length of fish in inches) x (water flow in gallons per minute). This index is also catalogued during two-week intervals coinciding with feeding period.

Risks **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
3. Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.	Meet requirements of National Pollution Discharge Elimination (NPDE) permit specifically, Total Suspended Solids Settleable Solids Water Temperature (Hatchery) Dissolved Oxygen (Hatchery).	Total Suspended Solids (TSS) 1 to 2 times per month on composte effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples. Settleable Solids (SS)-1 to 2 times per month on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples. In-hatchery Water Temperatures-maximum and minimum daily. In hatchery Dissolved Oxygen- as required by stream flow or weather conditions.
4. Hatchery program addresses ESA responsibility	ESA consultations under Section 7 have been completed, Section 10 permits have been issued, or HGMP has been determined sufficient under Section 4(d) as applicable, and avoiding overharvest of non-target species has been addressed.	HGMP drafts have been submitted during 1999 and 2002 (this document) to assess hatchery program ESA responsibilities. In addition, a formal biological assessment was conducted during 1994 by USFWS (USFWS 1994), mandated by NMFS, for possible effects of Spring Creek NFH on listed Snake River sockeye salmon (Oncorhynchus nerka) and listed wild Snake River spring/summer and fall Chinook. Spring Creek NFH also fulfilled requirements set forth by USFWS concerning section 7 of the ESA when recently performing a hatchery construction project (see Addendum A).

Risks Performance Standards	Performance Indicators	Monitoring and Evaluation
5. Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	A proportion of each release group is marked with a coded wire tag and adipose clip. Hatchery goal: ≥ 3.0% Unfed fry released are otolith marked (100% marking rate) by thermal manipulation.	Tagged proportions of smolt and unfed fry releases adequately provide USFWS personnel and Columbia River fisheries managers of harvest and return rates of tule fall Chinook adults by brood year. For brood years 1980-94, an average of 4.38% of tule Chinook smolts were coded wire tagged. All unfed fry releases have been, and will continue to be, thermally marked.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The hatchery has the capacity to rear 60,000,000 eggs, which equates to about 24,000 adults collected. To meet the current production goal of 20,000,000 eggs, a minimum of 7,000 adults (4,000 females) is required. Typical hatchery practices have been to collect 11,000-12,000 adults, which equates to around 23,000,000 eggs. This allows collection of the full spectrum of the adult migration, with a measure of insurance in case of any unforeseen drops in the latter part of the run.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	White Salmon River	1,500 - 5,000[1]
Unfed Fry	On-Site (Columbia River)	3,000,000
Fry	-----------	0
Fingerling	On-Site (Columbia River)	15,100,000
Yearling	-----------	0

[1] – These fish are distributed to Whitson elementary school (White Salmon, WA) as eyed eggs and are released at the fingerling stage as part of an environmental education program.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The following table indicates escapement to Spring Creek National Fish Hatchery and to the mouth of the Columbia River. In addition, the total adult production number is given which includes all estimated sport, tribal, commercial, and international harvest of tule adult Chinook from Spring Creek NFH. Tule Chinook smolt to adult survival rate is also given for each brood year. Data presented in this table is calculated from the Columbia River Information System or CRiS (Stephen M. Pastor, August 2002).

Brood Year	Escapement		Total Adult Production Number[1]	Smolt to Adult Survival Rate (Hatchery Goal ≥ 0.5%)
	Hatchery (Goal: >7000)	Columbia River		
1980	4634	7433	29088	0.186
1981	7366	15838	46551	0.371
1982	16268	65631	140827	0.984
1983	986	8638	16060	0.146
1984	481	2407	6418	0.046
1985	785	5330	13708	0.129
1986	5812	17824	46050	0.433
1987	5244	7388	27326	0.309
1988	14331	30548	79102	0.517
1989	8368	11646	46793	0.457
1990	6251	5420	21313	0.149
1991	9693	9995	29941	0.157
1992	7771	12139	23488	0.164
1993	67	26524	31870	0.204
1994	5837	6189	16433	0.103
1995	2643	3586	8050	0.049
Mean	6034	14784	36439	0.275

[1]Includes adult fish captured in tribal, sport and commercial harvest in freshwater or saltwater and escapement to Spring Creek NFH.

1.13) Date program started (years in operation), or is expected to start.

Spring Creek National Fish Hatchery was founded and began rearing tule fall Chinook in 1901.

1.14) Expected duration of program.

One of the main purposes of this program is to mitigate for spawning habitat lost by the creation of dams in the main stem of the Columbia River. Given that much of this habitat is irretrievably lost (unless several major dams are removed) this production program is expected to continue for the foreseeable future.

1.15) Watersheds targeted by program.

All fish reared in this program are released and expected to return to the Bonneville pool of the Columbia River (WRIA 29).

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

No alternative actions are proposed at this time.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS. (Non-Salmonid Species are addressed in ADDENDUM A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Biological Assessment for Mitchell Act Hatchery Operations. Hatcheries and Inland Fisheries Branch, Portland, Oregon (NMFS 1999a)
Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999b).

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- Identify the ESA-listed population(s) that will be directly affected by the program.

The Spring Creek NFH stock is part of the lower Columbia River Chinook ESU listed as Threatened but the hatchery component of this ESU is not listed. Spring Creek NFH uses tule fall Chinook broodstock of hatchery origin and no listed species are expected to be directly affected by the Spring Creek NFH program.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

ESA-listed populations that may be incidentally affected by the Spring Creek NFH program in broodstock collection areas include:

Snake River fall-run Chinook salmon ESU (Threatened)
Snake River spring/summer-run Chinook salmon ESU (Threatened)
Snake River sockeye salmon ESU (Endangered)
Snake River Basin steelhead ESU (Threatened)
Upper Columbia River spring-run Chinook salmon ESU (Endangered)
Upper Columbia River steelhead ESU (Endangered)
Middle Columbia River steelhead ESU (Threatened)
Lower Columbia River steelhead ESU (Threatened)
Lower Columbia River Chinook salmon ESU (Threatened)
Lower Columbia River Coho Salmon ESU (Candidate)
Columbia River chum salmon ESU (Threatened)
Columbia River Bull Trout (Threatened)
Cutthroat Trout (Candidacy reviewed but not warranted 7/2002)

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Natural spawning fall Chinook salmon in the Wind and White Salmon rivers are not negatively impacted by the Spring Creek tule fall Chinook program. The natural fall Chinook population in the Wind River is considered extinct by Nehlsen et al. (1991). NMFS gives a long-term abundance trend (1960-1984) as negative, - 0.5 % per year based on peak or index counts (Myers et al. 1998) for natural fall Chinook in the Wind River. The White Salmon River population of natural fall Chinook is considered possibly extinct by Nehlsen et al. (1991). NMFS gives a long-term abundance trend (1965-1984) as negative, - 4.1 % per year based on peak or index counts (Myers et al. 1998) for natural fall Chinook in the White Salmon River. Furthermore, Washington Department of Fisheries (WDF et al. 1993) considers these two naturally spawning populations as depressed stocks of mixed origin with composite production (wild and hatchery fish). In the Wind River, NMFS lists a five-year geometric mean natural spawning population size of 30 fish. The short term abundance trend (the most recent 7-10 years, based on total escapement) is negative, - 31.3 % per year. The long term abundance trend (1967-1996) is also negative, - 7.2 % per year (Myers et al. 1998). In the White Salmon River, NMFS lists a five-year geometric mean natural spawning population size of 127 fish. The short term abundance trend (the most recent 7-10 years, based on total escapement) is negative, - 9.7 % per year. The long-term abundance trend (1965-1996) is also negative, - 9.2 % per year (Myers et al. 1998).

Natural spawning fall Chinook in the Hood River are supported by the Spring Creek tule fall Chinook program. Hood River fall Chinook are very depressed with escapements over Powerdale Dam (RM 4.5) from 1992 to 1999 averaging 24 adults. It is thought that most of the natural spawning occurs below Powerdale Dam. An examination of scales sampled from returning fall Chinook adults at Powerdale Dam show that 19% are of hatchery origin (presumably from Spring Creek NFH) (ODFW 2001).

Due to the construction of Bonneville Dam in 1938, mainstem spawning areas for natural populations of tule fall Chinook were inundated and mainstem spawning, in the target area, no longer occurs. Very limited spawning areas in local tributaries, such as the Wind and White Salmon Rivers, support small populations of tule fall Chinook, but these naturally spawning fish are thought to be largely supported by Spring Creek NFH strays (NMFS 1999c).

Since 1986, the Klickitat River in south-central Washington has also supported a "natural" tule fall Chinook run with an average escapement of 675 adults from 1995-1999 (Sharp et al. 2000). This population, which is primarily composed of hatchery strays, has included stocks from Cowlitz, Toutle, Kalama, Washougal, Bonneville, Cascade, Ringold and Spring Creek hatcheries (Sharp et al. 2000). Artificial propagation of Tule fall Chinook stopped in 1985 due to an insufficient number of eggs being transferred from Spring Creek NFH.

Threatened Mid-Columbia River steelhead are present in the White Salmon and Klickitat Rivers the nearest tributaries to SCNFH. Natural steelhead production in the White Salmon River is limited to the 3.3 miles of river below Condit Dam. WDW et al. (1990) estimated that the natural winter steelhead run size is 50 adults annually. Native naturally produced summer steelhead are not believed to be distinct from hatchery produced Skamania stock summer steelhead that have been released into the White Salmon River since 1982. The Klickitat River contains both naturally produced winter and summer steelhead populations. Accurate estimates of abundance for the winter and summer steelhead populations are very difficult to obtain for steelhead in general and for Klickitat River populations in particular because of high spring flows. Redd count estimates from 1996-2000 indicated an average escapement of 260 fish. This is undoubtedly an under estimate because historical harvests have shown catches averaging over 4,000 natural summer steelhead from 1981-1986 (WDF et al. 1990). State and tribal fisheries managers are currently remodeling passage facilities at Lyle Falls (RM 2.2) to provide escapement estimates of winter and summer steelhead.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Recent spawning abundance is not available for the Wind, White Salmon and Hood Rivers only the trend data provided in Myers et al. (1998).

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Annual proportions of hatchery and natural fall Chinook in the Wind, White Salmon and Klickitat Rivers are not available, but the naturally spawning populations of tule fall Chinook are thought to be largely supported by Spring Creek Hatchery fish (see above sections).

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>

Broodstock collection activities by Spring Creek NFH could potentially lead to the accidental take of listed species entering the hatchery or Bonneville Dam's North Shore trapping facility in years of low return.

Returning adults enter the hatchery by swimming up a ladder that flows from the adult holding ponds to the Columbia River. Adult fish typically begin to return to the hatchery in late August and are collected until the migration to the hatchery stops in late September. The table below identifies years when non-target species entered Spring Creek NFH or were identified within holding ponds, the number that entered, and the outcome of entrance. Data is presented from CRiS (Stephen M. Pastor August 2002) database from 1987-2000 broodstock collection years.

Year	Species	Number	Outcome
1994	Upriver Bright Fall Chinook	60	Returned to Columbia River
1995	Upriver Bright Fall Chinook	35	Returned to Columbia River
1996	Spring Chinook Salmon	2	Dead in adult holding pond
	Upriver Bright Fall Chinook	1	Dead in adult holding pond
	Upriver Bright Fall Chinook	35	Returned to Columbia River
1997	Upriver Bright Fall Chinook	1	Dead in adult holding pond
	Upriver Bright Fall Chinook	33	Returned to Columbia River
1998	Coho Salmon	1	Surplus
	Coho Salmon	5	Returned to Columbia River
	Upriver Bright Fall Chinook	1	Surplus
	Upriver Bright Fall Chinook	2	Dead in adult holding pond
	Upriver Bright Fall Chinook	112	Returned to Columbia River
	Winter Steelhead	4	Returned to Columbia River
1999	Upriver Bright Fall Chinook	5	Dead in adult holding pond
	Upriver Bright Fall Chinook	39	Returned to Columbia River
2000	Coho Salmon	2	Returned to Columbia River
	Summer Steelhead	1	Returned to Columbia River
	Upriver Bright Fall Chinook	10	Dead in adult holding pond
	Upriver Bright Fall Chinook	34	Dead in adult holding pond

During years when the hatchery escapement goal of 7000 may not be achieved, the hatchery can collect fish at Bonneville Dam's North Shore trapping facility. Since Spring Creek is the only hatchery above Bonneville Dam that rears tule fall Chinook and the ease of identification due to their coloration, the likelihood of collecting a non-Spring Creek tule is minimized. However, some naturally produced tule fall Chinook from the White Salmon, Wind, Hood and possibly the Klickitat rivers could be collected at Bonneville or volunteer into the hatchery, but numbers would be extremely low and there is no way to distinguish between hatchery fish and their natural counterparts. Other fall Chinook stocks and species are easily by-passed at the facility based on visual identification.

-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

The following tables (two following pages) list take levels of listed adult fish resulting from Spring Creek NFH program operations.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Coho Salmon ESU/Population: Lower Columbia ESU Activity: Broodstock Collection				
Location of hatchery activity: Spring Creek National Fish Hatchery Dates of activity: Late August – Early September Hatchery program operator: USFWS Hatchery and Non-Hatchery Staff				
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Type of Take				
Observe or harass a) Hatchery Fish Ladder or Broodstock Collection Ponds			<7	
Collect for transport b)				
Capture, handle, and release c)			<7	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			1	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Steelhead (Winter or Summer run) ESU/Population: Lower Columbia, and MCR ESUs Activity: Broodstock Collection				
Location of hatchery activity: Spring Creek National Fish Hatchery Dates of activity: Late August – Early September Hatchery program operator: USFWS Hatchery and Non-Hatchery Staff				
	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Type of Take				
Observe or harass a) Hatchery Fish Ladder or Broodstock Collection Ponds			<5	
Collect for transport b)				
Capture, handle, and release c)			<5	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			1	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Hatchery broodstock collection activities will be evaluated, discussion among USFWS personnel will be initiated, notification to NMFS parties will occur, and immediate actions for decreasing or eliminating take levels will be instituted.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies. Explain any proposed deviations from the plan or policies.

Spring Creek NFH operates in compliance with the 1999 NMFS Biological Opinion on Columbia River Hatcheries and with the Northwest Power Planning Council Annual Production Review (document 99-15) description of mitigation hatcheries.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

The tule fall Chinook program is consistent with:
- NMFS 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin.
- U.S. v. Oregon Columbia River Fish Management Plan
- 2002 Management Agreement for Upper Columbia River Fall Chinook, Steelhead, and Coho.
- Mitchell Act
- John Day Dam mitigation agreement with U.S. Army Corps of Engineers.
- U.S./Canada Pacific Salmon Treaty (Spring Creek tule stock is one of the tagged exploitation rate indicator stocks).
- IHOT policies and Procedures for anadromous Salmon hatcheries.

3.3) Relationship to harvest objectives.

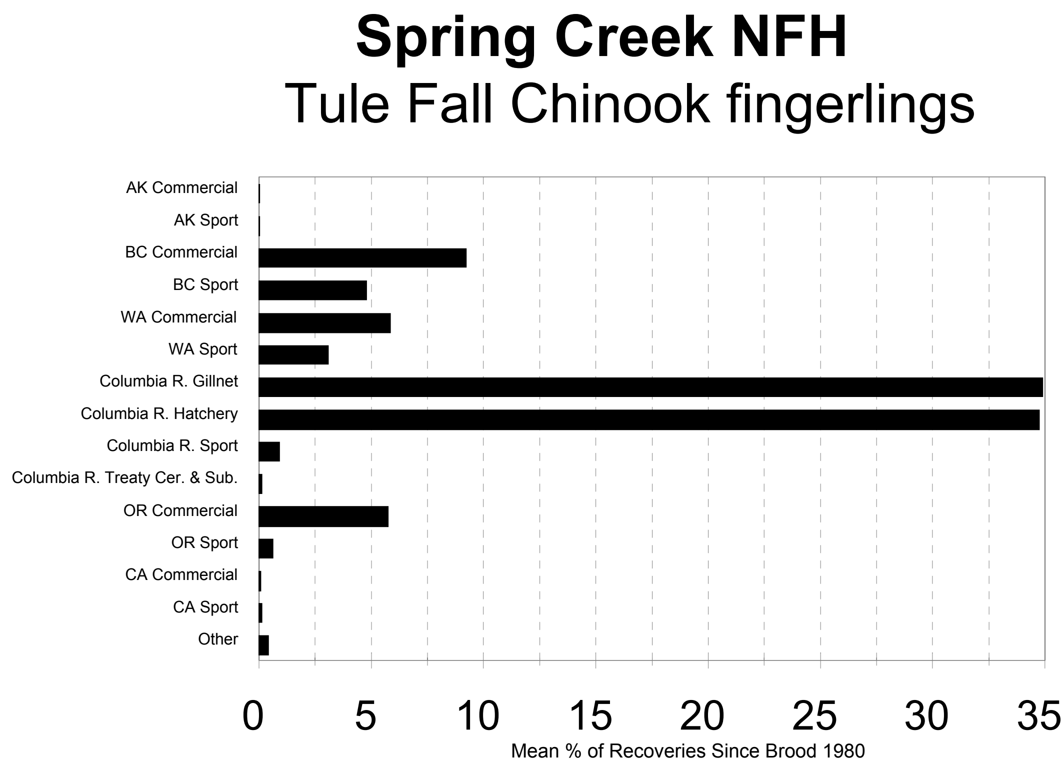
Currently, west coast ocean fisheries are managed to achieve the NMFS biological opinion jeopardy standards, which requires an overall coast-wide 30% reduction in the harvest rate of Snake River wild fall Chinook for the 1988-1993 base period for in-river fisheries. For Columbia River fisheries, treaty allocation requirements dictate that most of the allowable impacts on Snake River Chinook and other concurrently migrating harvestable fall Chinook, including Spring Creek tule fall Chinook, occur above Bonneville Dam.

The Spring Creek stock is part of the lower Columbia River Chinook ESU but the hatchery component is not listed. The lower Columbia River Chinook ESU escapes significant mainstem harvest rate impacts in the lower river as a result of the current design of the fishery. A small population of the naturally spawning lower Columbia River Chinook ESU occurs above Bonneville Dam. This population presumably experiences a higher harvest rate in tribal fisheries than the populations below Bonneville Dam. The potential for higher harvest rates on a couple of the small tributary populations above Bonneville Dam, believed to be largely supported by locally spawning Spring Creek NFH tule fall Chinook, is not expected to have a significant impact on the overall ESU. Because harvest rate jeopardy standards for Snake River fall Chinook dictate the management of both ocean and in-river fisheries under a weak-stock management approach, the Spring Creek fall Chinook program fish are not expected to have a significant impact on listed species. The 1999 fall-season harvest biological opinion determined that fisheries did not jeopardize any listed species (NMFS 1999c).

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Production from Spring Creek NFH contributes significant harvest to important ocean (including Canadian) and in-river commercial, sport, and tribal fisheries (Graph 3.3.1). Average exploitation for brood years 1982-1989 was 0.800 (CTC 1994). Exploitation rate declined somewhat as greater fishery restrictions were imposed during the latter portion of that period resulting in a 1987-1989 brood year average exploitation rate of 0.753. In Table A-1 of Preseason Report III, the Salmon Technical Team reported that current total exploitation rate on the Spring Creek (Bonneville Pool) hatchery stock is about 0.670, with nearly half of the impacts occurring in-river primarily in the Zone 6 area above Bonneville Dam (STT 1999).

Graph 3.3.1. Mean percent (%) coded wire tag recoveries by fishery for Spring Creek NFH tule fall Chinook. Data presented is from 1980-1994 (CRiS, Stephen M. Pastor August 2002).



3.4) Relationship to habitat protection and recovery strategies.

The major factor inhibiting natural production of tule fall Chinook salmon is the inundation of available natural spawning areas in the mainstem Columbia River as a result of the construction of Bonneville Dam in 1938. If mitigation goals are to be achieved, continued hatchery production will be necessary to replace lost habitat.

3.5) Ecological interactions.

Salmonid and non-salmonid fishes or other species that could:

1) negatively impact program;

A variety of freshwater and marine predators such as northern pikeminnows, Caspian terns, and pinnipeds, can significantly reduce overall survival rates of program fish. Predation by northern pikeminnow poses a high risk of significant negative impacts on the productivity of hatchery Chinook (SWIG 1984). Based on PIT tags recovered at a large Caspian tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1997). The Fish Passage Center

(Berggren 1999) estimates, from about 57,000 PIT tag recoveries from Rice Island, that through 1991, about 0.2% of all PIT tagged fish released into the Columbia River showed up on Rice Island. That percentage had increased by a factor of ten by the 1997 and 1998 juvenile salmonid out-migrations, with hatchery and wild steelhead having been the most effected by the increased predation. A NMFS Working Group (NMFS 1997) determined that California sea lion and Pacific harbor seal populations in the three west coast states have risen by 5-7% annually since the mid-1970s. Their predation on salmonids may now constitute an additional factor on salmonid population declines and can effect recovery of depressed populations in some situations.

2) be negatively impacted by program;

Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Willamette River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Upper Willamette River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). An additional concern is the Southwestern Washington/Columbia River coastal cutthroat trout ESU. See the ecological interactions discussion below.

3) positively impact program;

Returning Chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system.

4) be positively impacted by program;

A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Reductions and extinctions of wild populations of salmon could reduce overall ecosystem productivity. Because of this, hatchery production has the potential for playing an important role in population dynamics of predator-prey relationships and community ecology. The Service speculates that these relationships may be particularly important (as either ecological risks or benefits) in years of low productivity and shifting climactic cycles.

In addition, wild co-occurring salmonid populations might be benefited as schools of hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. See the ecological interactions discussion below.

The 1999 Biological Assessment for the Operation of Hatcheries Funded by the National Marine Fisheries Service under the Columbia River Fisheries Development Program (NMFS 1999a) and the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999b) present a discussion of the potential effects of hatchery programs on listed salmon and steelhead populations. The reader is referred to the discussion in those documents.

Nine generalized types of effects that artificial propagation programs can have on listed salmon and steelhead populations were identified. These effects include: 1. Hatchery operation, 2. Broodstock collection, 3. Genetic introgression, 4. Hatchery production (density-dependent), 5. Disease, 6. Competition, 7. Predation, 8. Residualism, and 9. Migration corridor/ocean. Potential effects in these categories may apply to all hatchery programs to one degree or another depending on the particular program design.

A discussion of ecological interactions relative to the Spring Creek tule fall Chinook program follows:

1. Hatchery operation- the water source for the Spring Creek NFH is from springs and a well and the hatchery operates under a 90% water reuse system. Water withdrawals for hatchery operation do not affect natural spawning anadromous salmonid populations. Hatchery effluents meet established NPDEP release standards criteria and are quickly diluted by the flow in the mainstem Columbia River reducing any potential negative impacts to natural stocks.

2. Brood stock collection- tule fall Chinook are collected for brood stock at the hatchery rack on the mainstem Columbia River. In addition, in years of very low return, supplemental brood stock have been collected at the Washington shore trapping facility at Bonneville Dam and transported to Spring Creek NFH. Tule fall Chinook are distinguished from the incidental return of bright fall Chinook by skin color and other prespawning maturation characteristics. Incidental bright fall Chinook returns to Spring Creek are few and these fish are released back into the Columbia River when possible. Recovery of non-Spring Creek CWT's at Spring Creek NFH is rare. It is believed that the majority of any incidental bright fall Chinook returning to Spring Creek NFH are likely strays from Little White Salmon NFH and Bonneville SFH bright fall Chinook production programs.

3. Genetic introgression- Spring Creek NFH tule fall Chinook are a part of the lower Columbia River Chinook ESU although the hatchery fish are not listed. The total number

of Spring Creek fish released is large relative to other Columbia River production programs so even a small stray rate can contribute significant numbers of hatchery fish to local naturally spawning populations. It is believed that natural spawning populations of tule fall Chinook in the Wind and White Salmon rivers may be largely supported by Spring Creek hatchery fish (NMFS 1999c). Spring Creek CWT's have been recovered during annual spawning ground surveys in these tributaries (Harlan 1999). Scale analysis of tule fall Chinook at Powerdale Dam on the Hood River has identified that approximately 20% of the fish are of hatchery origin (ODFW 2001). Genetic sampling of the naturally spawning populations in these local tributaries should be conducted and comparisons made to the Spring Creek stock to determine the level of stock similarity. However, even if genetic introgression has occurred in the Wind and White Salmon rivers, these naturally spawning populations are a small component of the overall lower Columbia River Chinook ESU. Available fall Chinook spawning area in the Wind and White Salmon rivers is limited because of inundation by Bonneville Pool when Bonneville Dam was constructed in 1938, and because of blockage by Condit Dam in the White Salmon River.

The native White Salmon River tule fall Chinook population was the founding source for Spring Creek tule fall Chinook. The Spring Creek stock is the stock of choice for reintroduction into the White Salmon River if and when Condit Dam is removed. Condit Dam removal is expected in 2006. Although Spring Creek hatchery fish may be largely supporting the Wind and White Salmon tule fall Chinook naturally spawning populations, genetic introgression of Spring Creek fish for the ESU as a whole is not considered a significant problem because the vast majority of the natural production for this ESU occurs below Bonneville Dam where there is not a documented history of significant straying of Spring Creek fish into natural production areas (Spring Creek CWT recoveries are rare). Furthermore, Spring Creek tule fall Chinook may be the stock of choice for future supplementation programs for individual tule populations within the ESU if this action is deemed necessary/appropriate. Compared to other hatchery populations of tule fall Chinook, the Spring Creek stock has likely retained many of the genetic and life-history characteristics of the original lower Columbia River tule Chinook population. This is because of Spring Creek's large annual spawning population and relative lack of historical brood stock transfers from outside sources into Spring Creek NFH compared to other lower river tule fall Chinook facilities.

4. Hatchery production (density dependent effects)- Spring Creek NFH has a large production program (15.3 million smolt release) relative to other Columbia River production programs. The Spring Creek facility is operated under a strategy that releases smolts during three time periods: March, April, and May. This release strategy maximizes production from available rearing space. The three-release strategy also likely reduces potential density dependent effects, as well as other potential ecological effects, at least in the mainstem corridor and estuary, relative to a single large release. Approximately one-half of the total production is typically released in March, with the remaining production split approximately equally between April and May releases. The March release occurs before the general out-migration of most other natural and hatchery stocks begins, reducing potential density dependent effects as well as other potential

ecological effects such as competition, predation, and disease transmission. Splitting the April and May releases reduces the potential for significant interactions on a particular component of the natural out-migration that may be emigrating from the Columbia River system at the same time as Spring Creek releases.

5. Disease-The Spring Creek tule fall Chinook salmon are healthy with low to no incidence of the regulated and reportable pathogens that plague other hatcheries (Fish Health Inspection Reports, 1982 to present, Lower Columbia River Fish Health Center). Adults return with a minor incidence of virus and bacteria so there is little or no vertical transmission of these pathogens to their offspring. Juvenile fish can be affected by pathogens carried by animals coming into the hatchery from the Columbia River or in the spring water source so their infections generally evolve from environmental pathogens external to the hatchery. Because Spring Creek juveniles are released directly into the mainstem Columbia River and pass only one dam (Bonneville Dam) en route to the ocean, there is reduced potential for transmission of pathogens to other populations. In comparison, other upriver programs are subjected to the high density impacts and stresses of collection for transport and/or diversion through multiple bypass systems which can trigger disease transmission. As a consequence, direct infection of natural fish by Spring Creek fish appears to be minimal.

6. Competition- the impacts from competition are assumed to be greatest in the spawning and nursery areas at points of highest density (release areas) and diminish as hatchery smolts disperse (USFWS 1994). Salmon and steelhead smolts actively feed during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). Competition in reservoirs could occur where food supplies are inadequate for migrating salmon and steelhead. The degree to which smolt performance and survival are affected by insufficient food supplies is unknown (Muir and Coley 1994). On the other hand, the available data are more consistent with the alternative hypothesis that hatchery-produced smolts are at a competitive disadvantage relative to naturally produced fish in tributaries and free-flowing mainstem sections (Steward and Bjornn 1990). Although limited information exists, available data reveal no significant relationship between level of crowding and condition of fish at mainstem dams. Consequently, at current populations levels the survival of natural smolts during passage at mainstem dams does not appear to be affected directly by the number or density of hatchery smolts passing through the system. While smolts may be delayed at mainstem dams, the general consensus is that smolts do not normally compete for space when swimming through the bypass facilities (Enhancement Planning Team 1986). The main factor causing mortality during bypass appears to be confinement and handling in the bypass facilities, not the number of fish being bypassed.

Juvenile salmon and steelhead, of both natural and hatchery origin, rear for varying lengths of time in the Columbia River estuary and pre-estuary before moving out to sea. The intensity and magnitude of competition in the area depends on location and duration of estuarine residence for the various species of fish. Research suggests, for some species, a negative correlation between size of fish and residence time in the estuary (Simenstad et al. 1982).

While competition may occur between natural and hatchery juvenile salmonids in - or immediately above - the Columbia River estuary, few studies have been conducted to evaluate the extent of this potential problem (Dawley et al. 1986). The general conclusion is that competition may occur between natural and hatchery salmonid juveniles in the Columbia River estuary, particularly in years when ocean productivity is low. Competition may affect survival and growth of juveniles and thus affect subsequent abundance of returning adults.

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate from the release site. Spring Creek fish are released directly into the mainstem Columbia River migration corridor rather than into tributary spawning or rearing areas. Based on Bonneville Dam sampling of juveniles, Spring Creek fish appear to emigrate rapidly, reducing the potential for competitive interactions with listed fish. Because Spring Creek releases occur "low" in the system relative to many other upriver programs, and emigration through the migration corridor appears to be rapid, there is reduced opportunity for competitive interactions. In addition, the three-release strategy also should reduce potential competitive interactions. (See hatchery production discussion above.)

7. Predation- depending on species and population, hatchery smolts are often released at a size that is greater than their naturally produced counterparts. In addition, for species that typically smolt at one year of age or older (e.g. steelhead, spring Chinook salmon), hatchery-origin smolts may displace younger year classes of naturally produced fish from their territorial feeding areas. Both factors could lead to predation by hatchery fish on naturally produced fish, but these effects have not been extensively documented, nor are the effects consistent (Steward and Bjornn 1990). A primary concern is the potential impact of predation by residualized hatchery steelhead on naturally spawning populations.

In general, the extent to which salmon and steelhead smolts of hatchery origin prey on fry from naturally reproducing populations is not known, particularly in the Columbia River basin. The available information - while limited - is consistent with the hypothesis that predation by hatchery-origin fish is not a major source of mortality to naturally reproducing populations in freshwater environments of the Columbia River basin (Enhancement Planning Team 1986). No information exists regarding the potential for such interactions in the marine environment.

The USFWS (1994) presented information that salmonid predators are generally thought to prey on fish approximately one-third or less their size. Spring Creek releases are of sub-yearling fish and are generally smaller than other yearling sized releases in the Columbia River. Therefore, it is likely that Spring Creek fish have reduced predatory impacts on natural stocks relative to other yearling releases. Because Spring Creek releases occur "low" in the system relative to many other upriver programs there is reduced opportunity for predatory interactions. In addition, the March release, (typically one-half of the total production) occurs before the start of the normal out-migration season for most other stocks, further reducing potential impacts on listed stocks.

Spring Creek tule fall Chinook released in March may have the potential to prey on listed chum salmon that would be emerging from the gravel in natural production areas below Bonneville Dam during that time frame. Peak emergence of chum at Ives Island was estimated to occur during the latter half of March in 1999 (2/19/99 fax to Donna Allard USFWS from Wayne Vander Naald, ODFW). It is believed that chum fry exit the nursery area shortly after emergence. Length samples for chum fry collected in the Ives and Pierce Island juvenile sampling area with stick seines in 1999 ranged from 32 to 42mm (4/1/99 fax from Fish Passage Center to Salmon Managers). Significant impacts on the listed chum population in the natural production area immediately below Bonneville Dam are not expected because juvenile sampling at Bonneville Dam and in the natural production area below Bonneville Dam indicates that Spring Creek smolts released in March move rapidly through the area. In addition, the emerging chum fry are generally larger than would be preyed upon by Spring Creek smolts released in March, which are generally about two times the length of the chum fry rather than three times their length. It is expected that most of the chum fry would have emigrated from the natural production area before the April release of larger Spring Creek tule fall Chinook occurs, further reducing the potential for impacts. Out-migrant sampling conducted by the USFWS in 1998 and 1999 in Hardy Creek, which is adjacent to the mainstem Pierce/Ives Island natural production area, indicated that peak emigration of chum fry occurred during the first two weeks of March (unpublished data). Interactions of program fish and chum in the estuary and ocean are unknown.

Spring Creek releases may contribute to indirect predation effects on listed stocks by attracting predators (birds, fish, pinnipeds) and/or by providing a large forage base to sustain predator populations. On the other hand, a large mass of hatchery fish moving through an area may confuse or distract predators or have a "swamping" effect towards predators providing them prey that are more readily accessible than wild stocks, thereby providing a beneficial effect to listed species. Releasing large numbers of hatchery fish may lead to a shift in the density or behavior of non-salmonid predators, thus increasing predation on naturally reproducing populations. Conversely, large numbers of hatchery fish may mask or buffer the presence of naturally produced fish, thus providing sufficient distraction to allow natural juveniles to escape (Park 1993). Prey densities at which consumption rates are highest, such as northern pikeminnow in the tailraces of mainstem dams (Beamesderfer et al. 1996; Isaak and Bjornn 1996), have the greatest potential for adversely affecting the viability of naturally reproducing populations, similar to the effects of mixed fisheries on hatchery and wild fish. However, hatchery fish may be substantially more susceptible to predation than naturally produced fish, particularly at the juvenile and smolt stages (Piggins and Mills 1985; Olla et al. 1993).

Predation by birds and marine mammals (e.g. seals and sea lions) may also be significant source of mortality to juvenile salmonid fishes, but functional relationships between the abundance of smolts and rates of predation have not been demonstrated. Nevertheless, shorebirds, marine fish, and marine mammals can be significant predators of hatchery fish immediately below dams and in estuaries (Bayer 1986; Ruggerone 1986; Beamish et al. 1992; Park 1993). Unfortunately, the degree to which adding large numbers of hatchery smolts affects predation on naturally produced fish in the Columbia River estuary and marine environments is unknown, although many of the caveats associated with predation by the northern pikeminnow in freshwater are true also for marine predators in saltwater.

8. Residualism- Spring Creek releases are not known to residualize in the mainstem Columbia River corridor where they are released. Juvenile sampling at Bonneville Dam indicates that Spring Creek fish rapidly emigrate from the release site.

9. Migration corridor/ocean- The hatchery production ceiling called for in the Proposed Recovery Plan for Snake River Salmon of approximately 197.4 million fish (1994 release levels) has been incorporated by NMFS into their recent hatchery biological opinions to address potential mainstem corridor and ocean effects as well as other potential ecological effects from hatchery fish. Although hatchery releases occur throughout the year, approximately 80 percent occur from April to June (NMFS 1999a). Approximately one-half of Spring Creek's production is typically released in March before the general out-migration for other hatchery and natural populations gets underway. The total number of hatchery fish released in the Columbia River basin has declined by about 26 percent since 1994 (NMFS 1999c) reducing potential ecological interactions throughout the basin.

Ocean rearing conditions are dynamic. Consequently, fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in nearshore areas affected by upwelling (Chapman and Witty 1993). To date, research has not demonstrated that hatchery and naturally produced salmonids compete directly in the ocean, or that the survival and return rates of naturally produced and hatchery origin fish are inversely related to the number of hatchery origin smolts entering the ocean (Enhancement Planning Team 1986). If competition occurs, it most likely occurs in nearshore areas when (a) up-welling is suppressed due to warm ocean temperatures and/or (b) when the abundance or concentration of smolts entering the ocean is relatively high. However, we are only beginning to understand the food-chain effects of cyclic, warm ocean conditions in the eastern north Pacific Ocean and associated impacts on salmon survival and productivity (Beamish 1995; Mantua et al. 1997). Consequently, the potential for competition effects in the ocean cannot be discounted (Emlen et al. 1990).

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Hatchery rearing water is primarily derived from several springs emerging from a bluff located on hatchery property. A warm water well is also located on hatchery property and is mixed with spring water to increase water temperature thereby allowing manipulation of growth and developmental rates.

Hatchery spring water is supplied by gravity to a distribution box on station. This water is pumped to a de-aeration tower and packed coke ring column to remove excess nitrogen. Well water is mixed with spring water in the de-aeration pit to manipulate incubation temperatures. Production water (water exiting from rearing ponds) is recirculated through the biological filters to the aeration chamber and back to the rearing ponds. Approximately 2,000 - 3,000 GPM of de-aerated fresh spring water is being added constantly to the reuse system. The present reuse water system wastes away 10% of the total available water to the wastewater lagoon (½ mile away) --- a series of two settling ponds that eventually drain into the Columbia River. During incubation and early rearing, water temperature is increased to 50 °F by mixing spring (47 °F) and well water (66 °F).

The hatchery has been issued the following permits: Spring water --- Permit No. 6716 11/04/53 - 12.0 sec. ft. and Permit No. 12045 dated 11/04/53, Well Water --- Permit No. G 228217, and NPDES Permit No. --- WA-000022-1.

4.2) Indicate the risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, of effluent discharge.

Screening criteria do not apply because there are no fish in the springs where hatchery water is withdrawn. Prior to entering the Columbia River, hatchery effluent passes through a water treatment lagoon consisting of settling and aeration ponds. Hatchery effluent is within all state and federal regulations, and water quality is monitored on a monthly basis by hatchery staff (when fish are present) and reported quarterly to the US Environmental Protection Agency.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adult spawners are collected as they return to the hatchery in late August, and September. To enter the hatchery, adult fish must swim up a fish ladder that flows between the rearing (and adult holding) ponds and the Columbia River. Once at the top of the ladder, adult fish are enumerated and directed into appropriate holding ponds by hatchery staff. During the migration season, hatchery personnel are on duty 16 hrs daily (1st and 2nd shifts) to enumerate and direct returning fish. During the night (3rd shift), a night watchman is on hand, but a gate at the top of the ladder is closed to prevent uncounted fish from entering the holding ponds.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Fish transport is rarely, if ever, used. If fish transport is required, tank trucks can be borrowed from other service or state hatcheries.

5.3) Broodstock holding and spawning facilities.

Adult fish come into the hatchery by swimming up a fish ladder, which drains directly into the Columbia River. From the top of the ladder, adults are directed into the rearing ponds (see sec 5.5 for description) that serve to hold broodstock during the spawning season. Holding ponds are provided with 750 gpm of hatchery spring / reuse water. To prevent fish from jumping between and out of ponds, 2' high jump boards are installed along the edge of each pond.

5.4) Incubation facilities.

The hatchery rears eggs and yolk sac fry in vertical (Heath type) incubators supplied with 3-7 gpm of de-aerated spring / well water. On-site 288 vertical units (16 trays ea, total of 4,432 trays) are housed in a 9,994 ft^2 incubation building. Also housed in the incubation building are 30 fiberglass troughs (16' x 14" x 14") for washing, shocking, and inventorying of eggs.

5.5) Rearing facilities.

Fry rearing is done in 44 concrete Burroughs ponds (17'W x 75'L x 4'D; 5100 ft^3, rearing space is 3300 ft^3 at 3' water depth). The incoming flow rate varies from 450 – 750 gpm (flow is increased with increasing fish size) of mixed spring / reuse water.

5.6) Acclimation/release facilities.

Off-site acclimation facilities are not used; fish are released directly from the rearing ponds.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

In 1970, the hatchery was remodeled into a 90% reuse system. Water used in the system is recirculated by means of several pumps, in the case of power outages, pumps can be operated by means of a 500 KW diesel generator. In the 30 years of operation, the hatchery has experienced many power outages, none of which resulted in a major system failure.

In 1985, the addition of a second species to Spring Creek NFH (Upriver Bright fall Chinook) initiated the onset of bacterial gill disease that killed millions of fish. A report by Talo (1999) summarizes operational errors that led to this event. In short, an increase in fish density, incompatible growth patterns for the two species, semi-functional filter beds and partial utilization of the reuse system facilities led to an estimated loss of up to 50% of the fish. A number of actions were immediately taken to insure that a similar situation would not occur.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

To avoid fish losses due to water system failure, the hatchery has a centralized monitoring and alarm system with flow and water level alarms located throughout the system. This alarm system is connected to a radio dialer with pagers as well as a telephone dialer. During the culture season, an “on-call” schedule ensures that someone is monitoring the alarm system at all times.

Fish health and disease transmission is handled according to the U.S. Fish and Wildlife Service’s Fish Health Policy, the “Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries” (IHOT 1995), and the Salmon Disease Control Policy of the Fisheries Co-Managers of Washington State as directed by the Lower Columbia River Fish Health Center. The tule fall Chinook salmon juveniles are fairly disease resistant and remain free of the reportable pathogens that plague some other stocks. Any health problems are managed promptly by fish health personnel to limit mortality and reduce disease transmission within the hatchery. If an immediate on-station release is the best course of action due to compromised health of hatchery fish, USFWS personnel will notify cooperating federal agencies and co-mangers of the intended action.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Adult tule fall Chinook collected from the White Salmon and Little White Salmon rivers provided the original source of eggs for the hatchery. Eggs were collected from the White Salmon starting in 1901 and continued uninterrupted until 1964. Eggs were also collected from the White Salmon in 1986 and 1987.

In 1972, 12 million eggs from the Toutle River State Hatchery (Washington Department of Fish and Wildlife) were brought into Spring Creek. The Toutle River stock originated from Spring Creek. Toutle River State Hatchery eggs were fertilized with Spring Creek NFH males and egg loss exceeded 50%. Less than 5 million smolts were released from this group.

In 1986, 1.1 million eggs were transferred from Little White Salmon National Fish Hatchery. These adults were strays from Spring Creek that entered the Little White Salmon River.

In 1987 and 1988 adult females were transferred from Bonneville State Hatchery (Oregon Department of Fish and Wildlife). These eggs were fertilized with Spring Creek NFH males. In 1987 and 1988, 6.1 and 13.1 million eggs were collected, reared and released at Spring Creek NFH. To minimize the effect on future brood year genetics, a spawning protocol was devised to minimize any genetic impairment (see section 8.3) and followed as closely as possible by Spring Creek NFH personnel.

6.2) Supporting information.

6.2.1) History.

The tule fall Chinook program started in 1901 when fall Chinook eggs were collected from both the White Salmon and the Little White Salmon rivers. Some of these eggs were incubated in spring water coming out of the basalt cliffs about a mile west of the confluence of the White Salmon and Columbia rivers. Within a few years adult salmon started returning to this spring water and eggs were collected.

From about 1925 through 1983, Spring Creek egg collections were large enough to supply egg needs to any hatchery that requested eggs. As a result of program changes there is not another hatchery program that rears Spring Creek tule fall Chinook.

During the mid 80's through the mid 90's Spring Creek experienced some major shortfalls in adult survival. To ensure that program goals were met, eggs were imported (see sec 6.1) from several other hatcheries. These facilities were heavily influenced (all stocks imported were founded from Spring Creek stock) by the Spring Creek stock and any potential impacts on genetics of the Spring Creek stock were minimized.

6.2.2) Annual size.

Spring Creek's minimum escapement goal is 7,000 adults of which 4,000 need to be females. There are still small numbers of tule fall Chinook spawning naturally in the White Salmon, Wind, and possibly Klickitat rivers (see section 2.2.2 for discussion). It is thought that these populations are influenced greatly by the hatchery stock. Some natural fish may stray into the hatchery, but the numbers are extremely low and there is no way to distinguish between hatchery fish and their natural counterparts. The natural spawning fish are considered part of the same ESU as the hatchery stock, but unlike the hatchery stock are listed for protection.

6.2.3) Past and proposed level of natural fish in broodstock.

Presently there are no plans to incorporate natural spawning fish into the hatchery brood stock. The hatchery possesses the capability to collect natural spawning fish with an adult trapping facility located on the White Salmon River. The hatchery has a long history of using native fish. Further, although natural fish are not currently a part of Spring Creek's broodstock program, the effective population size of the hatchery's spawning population is quite large (>5,000), and it is felt that the genetic integrity of the stock is intact.

6.2.4) Genetic or ecological differences.

It is assumed that the genetic and phenotypic characteristics of the present hatchery population is quite similar to the original natural stock from the White Salmon River. There is little if any recent data concerning this subject.

6.2.5) Reasons for choosing.

Spring Creek Hatchery was originally founded in the early 1900's in an effort to support the declining commercial fisheries in the Columbia basin. Tule fall Chinook from the White Salmon river were utilized because of their great abundance and the relative ease of collection (logistically speaking).

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Presently broodstock selection consists only of returning tule fall Chinook to the hatchery. Tule fall Chinook are easily identified by the darkened color of their skin and general declining appearance of health by hatchery staff. Selection of any other salmonids for spawning is highly unlikely.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult spawners are collected as they return to the hatchery site. In years of low adult return, spawners have also been collected from Bonneville Dam's north-shore trapping facility.

7.2) Collection or sampling design.

Broodstock are collected as they return to the hatchery. Returning adults enter the hatchery by swimming up a ladder that flows from the adult holding ponds to the Columbia River. As they exit the top of the ladder hatchery personnel enumerate and visually determine the putative sex of individual fish. Hatchery staff then direct individual fish to the adult holding ponds. This system allows the hatchery to track escapement goals, and prevents individual ponds from becoming overcrowded. Adult fish typically begin to return to the hatchery in late August and are collected until the migration to the hatchery stops in late September.

On years when the hatchery escapement goal of 7000 may not be achieved, the hatchery can collect fish at Bonneville Dam's North Shore trapping facility. Since Spring Creek is the only hatchery above Bonneville Dam that cultures tule fall Chinook and they are easy to identify because of their coloration, the likelihood of collecting a non-Spring Creek tule is minimized. Other fall Chinook stocks and species are easily by-passed at the facility based on visual identification.

7.3) Identity.

Tule fall Chinook are easily distinguished from other fall Chinook stocks and salmonid species based on coloration. All tules returning to the hatchery are assumed to be of hatchery origin --- all other fish are returned directly to the Columbia River.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

A minimum broodstock collection of 7,000 adults (4,000 females) is required. The hatchery strives for an effective population size ≥ 5,000.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs (millions)
1987[a]	2476	495	0	20.5
1988a	4076	696	125	39.7
1989a	2433	993	68	24.4
1990	3880	1166	0	20.7
1991	6435	3764	373	33.3
1992	4701	2705	0	24.1
1993	4257	2827	72	20.5
1994	5435	3886	134	26.2
1995	4924	2482	74	23.3
1996	3647	2266	91	16.2
1997	5267	2803	79	24.3
1998	2807	1700	106	11.9
1999	6095	3050	55	27.3
2000	2401	1551	75	11.8
2001	6265	4005	140	30.9
Mean	4340	2293	93	23.7

[a]Adult fish include fish captured in adult traps below and above Bonneville Dam and returning to Spring Creek NFH
Data source: CRiS (Stephen M. Pastor August 2002) database

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Adult fish arriving on station that are in excess of production requirements are given to the federal prisons food system, and to any treaty obligated tribes if requested.

7.6) Fish transportation and holding methods.

Adults typically begin to return to the hatchery in late August and continue to arrive on site until the end of September. Adult holding ponds are provided with 750 gpm of hatchery spring / reuse water. Ponds are checked daily for any moribund or dieing fish. All fish are held on site until ripe. The start of the spawning season begins in mid September and proceeds for about three weeks.

In years of low adult return, the hatchery has previously collected spawners from Bonneville dam's northshore fish trapping facility. Fish collected in this way are anaesthetized with MS-222 while handling and loading into the transport tank and immediately driven (total transport and loading time < 2 hr) to the hatchery where they are transferred into holding ponds and kept until ripe. Oxygen concentration is monitored and aeration is provided throughout transport.

7.7) Describe fish health maintenance and sanitation procedures applied.

At spawning, tissues from 150 female and 60 male adult fish are collected to ascertain viral, bacterial, and parasitic infections and to provide a brood health profile. Personnel from the Lower Columbia River Fish Health Center test for the parasite *Ceratomyxa shasta* and the listed pathogens including: infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum, Aeromonas salmonicida, and Yersinia ruckeri.* The samples collected are defined by USFWS policy 713 FW (Fish and Wildlife Service Manual). Sanitation procedures meet or exceed the minimum guidelines set forth in the IHOT report (1995)

7.8) Disposition of carcasses.

Any spawned or unspawned fish that are treated with anesthetic (MS-222) are disposed of as carcasses. These carcasses are disposed of off site by a commercial animal rendering service.

Beginning in 2001, Spring Creek tule carcasses have been used as the source for "carcass analog" pellets (BioOregon Company) which are being produced as a convenient disease-free fish product to enhance watershed productivity through nutrient enhancement. In the future, whole, untreated carcasses may be used for nutrient enhancement of nearby watersheds. Whole carcass outplanting for nutrient enhancement is not currently a goal of this program. However, if current policies change to include nutrient enhancement, outplanting will be done as per Lower Columbia River Fish Health Center recommendations to minimize potential disease transmission to resident and anadromous fish.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Natural spawning Tule fall Chinook salmon in the Wind, White Salmon, and Klickitat Rivers are not targeted populations of the Spring Creek tule fall Chinook broodstock program, although the potential collection of these naturally reared fall Chinook does remotely exist. See section 2.2.2 of this document for a detailed account of naturally occurring populations of tule fall Chinook. The tule fall Chinook stock at Spring Creek NFH is a relatively pathogen-free stock so the risk of disease transmission to other fish is low.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

All ripe females on a given day are spawned, any killed but judged to have green or bad eggs are discarded. Any excess adults that are surplused are done in such a manner that the excess fish are taken uniformly throughout the migration period.

8.2) Males.

The hatchery goal is the use 1 male to 1 female when possible but due to the selection of fish for spawning (see section 8.3) this does not consistently occur. Approximately 2 – 4% of the spawned males are jacks.

8.3) Fertilization.

On a given spawning day, fish are transferred to the spawning building, one pond at a time. Fish are crowded out of the pond and into the channel with manual crowders. Mechanical crowders are used to move the fish from the channel into a mechanical lift. While in the lift, fish are anaesthetized with MS-222, and then transferred onto the sorting table. While on the sorting table, ripe fish are segregated, and unripe fish returned to the holding ponds. All fish judged to be ripe are sent down the table where they are killed, and separated by sex. The females are bled by severing the caudal vein. Eggs are then removed by cutting the abdomen open with a Wyoming knife. Ovarian fluid is removed by draining the eggs in a colander. Eggs from a single female are placed in a bowl and fertilized with a single male (1:1 spawning ratio). Immediately after milt is added, saline solution is added and eggs mixed gently, this is to increase the distribution of sperm around the eggs and increase fertilization. Fertilized eggs are transferred to the incubation building where the milt is washed from the eggs, and water-hardening occurs. Fertilized eggs are placed into vertical incubators (Heath type) at a density of 7500 eggs / tray. All equipment used is routinely disinfected with an iodine solution. Any vessels used to hold eggs or sperm are disinfected between individual fish.

8.4) Cryopreserved gametes.

Not applicable.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

As mentioned in section 8.2, a male to female spawning ratio of 1:1 will be used to the best ability of hatchery staff and available brood. See section 7.9 for the potential collection of listed naturally rearing fall Chinook above Bonneville Dam.

SECTION 9. INCUBATION AND REARING –

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Hatchery Goals as presented in Section 1.10, Performance standard #2

≥ 95% egg to eye up
≥ 90% egg to fry (ponding)
≥ 97% fry to smolt (ponding to release)

Brood Year	Eggs Taken (millions) Hatchery goal > 17.8 million	Survival Egg to Eye-up (%) Hatchery goal >95%	Survival Egg to Pond (%) Hatchery goal >90%	Survival Pond to Release (%) Hatchery goal >97%
1988 [a]	21.72 [b]	80.2	77.9	90.5
1989 [a]	12.2 [b]	93.0	86.5	96.9
1990	20.72	91.7	85.8	97.7
1991	33.3	95.5	90.1	95.5
1992	24.14	96.3	93.3	96.3
1993	20.45	96.1	87.0	97.2
1994	26.2	95.4	91.1	98.8
1995	23.31	93.1		97.5
1996	16.22	93.2	90.5	98.0
1997	24.25	96.6	94.3	98.1
1998	11.89	95.7	92.6	96.3

1999	27.25	97.4	94.8	97.2
2000	11.76	94.4	92.4	97.3
2001	30.98	91.9	87.5	97.9
Mean ± SD	21.7 ± 6.8	93.6 ± 4.3	89.5 ± 4.6	96.8 ± 2.0

[a]Survival rates for this year are for eggs taken from Spring Creek NFH and from trap sites located above and below Bonneville Dam.
[b]Eggs taken from fish returning to hatchery only. For complete number of eggs taken during this year from trap sites and hatchery see Table 7.4.2.

9.1.2) Cause for, and disposition of surplus egg takes.

Eggs in excess of program goals are routinely taken in years of high adult returns. This is to ensure that fish from the entire spectrum of the migration period are used in the spawning population. If these excess eggs are not required by other production facilities / programs they are discarded (by burying on-site). A representative portion from each of the egg takes (spawning days) is maintained and additional eggs culled from the population. The decision about which egg baskets (within an egg take) to discard is largely determined on the base of egg quality and eye-up rate. All excess eggs discarded are at the eyed stage.

9.1.3) Loading densities applied during incubation.

Fertilized eggs are put down at a density of 1.5 females / tray (average 7500 eggs /tray). At eye-up eggs are shocked, salted, enumerated, and returned to the trays at a density of 4000 eggs / tray. Prior to eye-up eggs are provided with 3 gpm of de-aerated spring / well water. Following eye-up, flows are increased to 5-6 gpm.

9.1.4) Incubation conditions.

To manipulate growth and development of the eggs, well water (66 ºF) is added to the spring water (47 ºF) to maintain a temperature of 50 ºF. This mixing occurs prior to entering the de-aeration tower where culture water passes through a packed column of coke rings. Dissolved oxygen has never been an issue and is not routinely monitored.

9.1.5) Ponding.

Fry are ponded at 1500 – 1550 cumulative temperature units, which correspond to about 85% button-up. Swim-up and ponding are forced during mid to late December. The average size at ponding for the latest brood year was 1209 ± 6.7 fish / lb (± SE).

9.1.6) Fish health maintenance and monitoring.

Loss of eggs from fungal infestation has not been a problem, and disease treatments for the control of fungus are not routinely used. Eggs are treated regularly (3 time / week) with a low level of Iodophor (10 – 15 ppm) to control losses due to soft – shell. Yolk sac malformations are generally less than 0.2%. Egg mortality is on average less than 5%; the majority of dead / unfertilized eggs are removed during the shocking and salting process (at eye – up). Losses incurred during and after hatching are typically less than 3%, and are removed manually by hatchery staff. At ponding, a fish health exam is done on a 60 fish sample collected by the Fish Health Center.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

The hatchery component of the Lower Columbia River Fall Chinook ESU are not listed.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

See Section 9.1.1 for pertinent data.

9.2.2) Density and loading criteria (goals and actual levels).

Current hatchery rearing practices stipulate a density-index goal of no higher then 0.28, and a flow-index goal of no higher then 1.50 (see section 1.10 for computation of density and flow indices). Values for these two metrics rarely exceed the targeted goals, however density-index is generally higher than the target for the week or two prior to the March release. Fish left after the March release, are split into the empty ponds and the density index remains below target for the rest of the rearing season. Initial ponding is at a density of about 350,000 fish / pond (113 fish / ft^3), this density is maintained until the fish are split after the March release, when fish density decreases to around 210,000 / pond (68 fish / ft^3).

9.2.3) Fish rearing conditions

Water quality (O_2, NH_3, NO_2, NO_3, pH; before and after the filter beds) is measured weekly. Water temperature is monitored daily. Pond screens (drains) are cleaned as needed, at least weekly. Pond bottoms are cleaned with a brush as needed (weekly to monthly). The filter beds are backwashed on a biweekly basis at the beginning of the rearing period, and then on a weekly basis as the level of feed applied increases. For the first month to month and a half after ponding, well water (66 ºF) is mixed with spring water (47 ºF). This allows the hatchery to maintain a water temperature of 48-50 ºF, depending on weather conditions. The well is generally turned off by the first of February and water temperature is dependent on ambient conditions (47-49 ºF range).

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Overall fish size and culture conditions at the end of each month for all release groups from brood year 2001.

Month	Fork Length (in)	Weight (#/lb)	Condition Factor ($C*10^{-7}$)	Density Index (lbs fish / ft^3)	Flow Index[2]	Feed Conversion to date
Dec. 2001	1.7	729	2790	0.09	0.40	0.94
Jan. 2002	2.2	324	2900	0.16	0.75	0.75
Feb. 2002	2.8	154	2960	0.26	1.23	0.69
March 2002	3.4	85	2990	0.15	0.73	0.74
April 2002	4.1	48	3020	0.22	1.05	0.74

[2]- Flow index is calculated as lbs fish / (length of fish in inches)(gallons per minute inflow).

Please note that this data is provided to demonstrate general fish growth and culture characteristics of tule fall Chinook Salmon reared at Spring Creek NFH. This data combines values from three distinct release groups (March, April, and May) that are managed for different target release sizes and may be grown at considerably different overall rates (see section 9.2.6 for details).

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See section 9.2.4 for available data.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

All fish are fed (7 days/ week) by hand by hatchery staff. Feed size and type as well as feeding frequency are given below.

Fish Feed Size and FPP*	Number of Feeds Per Day 8	7	6	5	4
Biodiet #2 Starter 1100-800	X				
Biodiet #3 Starter 800-550	X				
Biomoist 1.0 mm 550-400		X			
Abernathy 3/64 400-200		X	X		
Abernathy 4/64 200-75			X	X	
Abernathy 6/64 75-				X	X

FPP = Fish Per Pound, these figures are the feed company's recommended feed sizes for the number of fish per pound.

For the first three weeks of culture, ponded fry are fed at a targeted rate of 0.016 inches / day. This rate is increased to 0.016 – 0.018 inches / day, and kept there until the March release. If water temperature drops (due to unusually cold weather) the targeted growth rate is reduced to 0.014 - 0.015 inches / day. After the March release growth rate is increased to 0.02 inches / day. A feed conversion factor of 0.85 – 0.9 (lb feed / lb growth) is maintained throughout the rearing period. During the two weeks prior to release, the feeding rate is increased by 10 %. After the initial month of culture, fish growth is assessed bi-weekly and condition factor determined monthly.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

The Lower Columbia River Fish Health Center (LCRFHC) in Underwood, WA provides fish health care for the Spring Creek NFH as described in the published policy 713 FW in the U.S. Fish and Wildlife Service Manual. In addition to this policy, the 1995 annual report "Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries", chapter 5, by the Integrated Hatchery Operations Team provides further fish health guidelines as approved by state, federal, and tribal agencies. The directives of these two documents meet the requirements of the Washington State and Tribal fish health agencies that follow the directives in the Washington Co-Managers' Salmonid Disease Control Policy of 1998.

A pathologist from the LCRFHC visits at least once per month to examine fish at the hatchery. From each stock of juveniles, fish are randomly sampled to ascertain general health. Based on pathological signs, age of fish, concerns of hatchery personnel, and the history of the facility, the examining pathologist determines the appropriate tests. This usually includes an external and internal examination of skin, gills, and internal organs. Kidneys (and other tissues, if necessary) will be checked for the common bacterial pathogens by culture and by a specific test for bacterial kidney disease (BKD). Blood is checked for signs of anemia or other infections, including viral anemia. Additional tests for virus or parasites are done if warranted.

A diagnostic exam is done on an as-needed basis determined by the pathologist or as requested by hatchery personnel. Fish that are sick, dying, and/or exhibiting unusual behavior are examined for disease with appropriate diagnostic tests. A pathologist will normally check symptomatic fish during a monthly examination. As needed, appropriate remedial or chemotherapeutant treatments will be prescribed to control or prevent disease outbreaks.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

The day before release, a sub-sample of the release group is exposed to a saltwater challenge and mortality and change in condition factor is recorded.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

None currently employed.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

The hatchery component of the Lower Columbia River Fall Chinook ESU is not listed.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	--------	--------	--------	--------
Unfed Fry	3,000,000	1200	Jan.	Columbia River
Fry	--------	--------	--------	--------
Fingerling	15,100,000	45 - 125	Mar., Apr., May	Columbia River
Yearling	--------	--------	--------	--------

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Columbia River, WRIA 29
Release point: river kilometer 269
Major watershed: Columbia River
Basin or Region: Columbia River basin

10.3) Actual numbers and sizes of fish released by age class through the program.

Tule fall Chinook release date and number at release are presented below. Data presented in this table is from the CRiS (Stephen M. Pastor August 2002) database and is presented in the Annual Stock Assessment – CWT Bonneville Project 198906500, Annual Report 2000 (Stephen M. Pastor 2000).

Release year	December		March		April		May		March, April, May Combined
	Unfed Fry (millions)	Avg size (number per pound)	Fingerling (millions)	Avg size (number per pound)	Fingerling (millions)	Avg size (number per pound)	Fingerling (millions)	Avg size (number per pound)	Fingerling (millions)
1989			7.55	116.3	3.78	67.6	3.96	36.9	15.29
1990			2.70	109.3	4.11	63.3	3.42	36.9	10.23
1991	3.29		6.86	123.3	4.09	67.81	3.39	41.6	14.34
1992	7.66		12.58	121.2	3.54	53.44	2.94	36.0	19.07
1993			6.85	137.9	3.97	89.5	3.47	45.8	14.29
1994			7.84	120.1	4.14	81.7	3.6	41.8	15.58
1995			7.94	111.7	4.26	77.5	3.79	44.9	15.99
1996			8.02	124.1	4.48	75.6	3.94	45.3	16.44
1997	6.92		7.17	120.0	3.92	67.2	3.46	40.9	14.55
1998			7.73	111.2	4.22	61.6	3.67	39.1	15.62
1999	3.11		4.07	116.5	3.53	74.6	2.99	60.1	10.59
2000			8.18	121.9	4.31	67.7	3.6	38.6	16.09
2001	3.04		5.31	117.6	5.26	60.0			10.57
Mean	4.81		7.14	119.3	4.12	69.8	3.52	42.3	14.47

10.4) Actual dates of release and description of release protocols.

Fish are released as fingerlings (smolts) and unfed fry. One unfed fry release occurs at ponding (range of release dates: 12/11 – 12/16), and three separate fingerling releases occur in March (5 yr range of dates: 3/8 – 3/13), April (5 yr range of dates: 3/28 – 4/22), and May (5 yr range of dates: 4/30 – 5/19). The unfed fry release date is dependent on water temperature and developmental rate of the eggs. The date of the March release is largely dictated by loading densities at the hatchery and coincide with an approved spill request to the Corps of Engineers, a total dissolved gas waiver from Oregon Department of Environmental Quality (ODEQ), and an adjusted dissolved gas standard from Washington Department of Ecology (WDEQ) for increased spill at Bonneville Dam for a ten day period (see brief discussion below). April and May release dates are more flexible and can be changed on the basis of river conditions, growth, health and development of the fish. Fish are forcibly released on a per pond basis. Although the hatchery would prefer to adopt a volitional release strategy, available facilities prevent this strategy from being used.

As mentioned previously, an approved spill at Bonneville Dam spillway has been routinely requested by USFWS since 1985 for the March release of juvenile tule fall Chinook (USFWS 2001). The purpose of this release is to increase the number of juvenile tule fall Chinook that survive passage at Bonneville Dam. This increased spill at Bonneville Dam increases the total dissolved gas (TDG) criterion above the state of Oregon standard of 110% below Bonneville Dam and to 115% TDG at the Camas-Washougal monitoring site, or an equivalent 120% TDG level in the Bonneville Dam Tailrace. Increase in Bonneville Dam spill has coincided with the March release of juvenile tule fall Chinook every year since 1985 except during 1995, which was in part due to lack of USFWS biological monitoring in the spill request proposal, and in 1998, when the basis for denying the spill request was unclear. Past monitoring by NMFS staff has shown migratory salmonids, resident fish, and invertebrates have not been significantly affected by TDG levels expected during the proposed spill (Toner and Dawley 1995, Dawley and Schrank 1995, DeHart 1995). In addition, the completed 2001 Gas Supersaturation Monitoring Report for Spill Below Bonneville Dam (USFWS 2001) found that only 3 of the 214 fish examined were positive for gas bubble trauma (GBT). The GBT exhibited by these fish also was the lowest level indicator, a single bubble in an observed area.

10.5) Fish transportation procedures, if applicable.

Not applicable.

10.6) Acclimation procedures (*methods applied and length of time*).

None used, all releases occur on station, fish are acclimated only to the hatchery water source.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

A proportion of each release group (roughly 3% or 150,000 per release group) is marked with a coded wire tag and adipose clip. Unfed fry released are otolith marked (100% marking rate) by thermal manipulation.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Reared fish in surplus of 15.1 million smolts (Spring Creek NFH goal for release) are released during the standard release periods of March, April, and May or during the unfed fry release. See Table 10.3 for years of unfed fry and surplus releases.

10.9) Fish health certification procedures applied pre-release.

At two to four weeks prior to a release or transfer from the hatchery, 60 fish from the stock of concern are tested for the presence of the listed pathogens. These pathogens, defined in USFWS policy 713 FW include infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum, Aeromonas salmonicida, Yersinia ruckeri*, and *Myxobolus cerebralis*. In addition, the LCRFHC provides another special exam (Goede's exam, Goede and Barton, 1990) of 10 randomly selected fish/raceway a few days prior to each release. This information is used by hatchery personnel to ascertain general health of the population in relation to their survival and return as adults.

Disease outbreaks from the listed pathogens are uncommon in the tule fall Chinook salmon. However, should a disease outbreak occur, the appropriate strategy for control (chemotherapy or cultural changes) will be recommended by the fish pathologist. Because Spring Creek is a facility where 90% of the water is re-circulated through bio-filter beds that are sensitive to some chemotherapeutants, it may be necessary to protect fish health by reducing densities in an approved early release. All early releases are done in accordance with the fish health policies of the USFWS, Washington and Oregon Co-Managers with notification to NOAA Fisheries prior to release.

10.10) Emergency release procedures in response to flooding or water system failure.

Fish will be released on station in case of emergency.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate from the release site. Spring Creek fish are released directly into the mainstem Columbia River migration corridor rather than into tributary spawning or rearing areas. Based on Bonneville Dam sampling of juveniles, Spring Creek fish appear to emigrate rapidly, reducing the potential for competitive interaction with listed fish. Because Spring Creek releases occur "low" in the system relative to many other upriver programs, and the emigration through the migration corridor appears to be rapid, there is reduced opportunity for competitive interactions. In addition, the three-release strategy (March, April, and May) also should reduce potential competitive interactions by reducing potential density dependent effects in the mainstem migration corridor and estuary. Approximately one-half of the total production is typically released in March, with the remaining production split approximately equally between April and May releases. The March release occurs before the general outmigration of most other natural and hatchery stocks begins, reducing potential density dependent effects as well as other potential ecological effects such as competition, predation, and disease transmission. Splitting the April and May releases reduces the potential for significant interactions on a particular component of the natural out-migration that may be emigrating from the Columbia River system at the same time as Spring Creek releases.

A Biological Assessment conducted by USFWS during 1994 (USFWS 1994) states that interaction resulting from competition for food and space between salmon released from SCNFH and Snake River listed salmon stocks is assumed to be minimal in the mainstem Columbia River. Spring Creek tule fall Chinook smolts released from Spring Creek NFH averaged 11.2 days (range 5.4 – 23.8) migration time to the Columbia River Estuary and residence time in the estuary was 3-4 days in 1968-1970 (Dawley et al. 1986). This provides further evidence of that there is a short amount of time for potential interactions with wild, listed fish.

Potential adverse ecological effects to listed and unlisted species are addressed annually within ODEQ Total Dissolved Gas (Criteria Modification) Petition (Attachment I.). In addition, the Gas Supersaturation Monitoring Report for Spill Below Bonneville Dam (USFWS 2001) also addresses these concerns and presents the most recent findings regarding USFWS monitoring of the requested March spill increases.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Refer to Section 1.10 for a discussion of how each "Performance Indicator" will be monitored and measured.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The USFWS expects to continue funding monitoring and evaluation programs associated with Spring Creek NFH as the monitoring and evaluation programs are currently designed and funded by NMFS, Bonneville Power Administration, U.S. Army Corps. Of Engineers and USFWS. Further monitoring and evaluation programs could be initiated in the future.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Ecological interactions between Spring Creek fish and other stocks of fish, in the mainstem corridor of the target area, are presumed to be minimal. Present monitoring and evaluation as detailed in Section 1.10-1.12 occur on hatchery therefore, would not affect listed salmonids. More attention needs to be devoted to the development of ecological interaction studies in the local tributaries with funding provided to complete specific studies. Ecological interaction studies should compliment projects under Section 12 of this document.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

Since its inception in 1091, the SCNFH tule fall Chinook salmon production program has reared unfed fry (surplus eggs that are hatched and incubated through swim-up in the hatchery and released directly into the Columbia River). Unfed fry releases were discontinued during the early 1970’s after which followed a marked decrease in Spring Creek NFH adult returns and continuing unfed fry releases. In 1991, adult returns increased slightly to allow Spring Creek NFH to meet production goals and use excess production to again perform unfed fry releases. Unpublished research conducted by USFWS during the late 1950’s and early 60’s suggested that Spring Creek NFH unfed fry did survive and returned to the hatchery at a rate of 0.0022%, a lower survival rate than expected, possibly due to pectoral and adipose fin clip marking . Potentially, the unfed fry release program may enhance the Columbia River tule fall Chinook salmon fisheries and hatchery escapement in addition to maintaining genetic diversity and stock vitality in Spring Creek NFH tule fall Chinook.

Two major changes to the unfed fry releases at Spring Creek NFH presented an opportunity to assess the modern day survival of fry to adult returns; otolithography (thermal marking of otoliths) and a December release date. Otolithography, a process involving the formation of dense bands on an otolith through water temperature manipulation during egg incubation, is a cost effective distinguishable mark for unfed fry and may result in less delayed mortality and less hampered swimming performance compared to fin clipping. Each brood year of the study (1999 – 2001) has/will have a unique mark pattern (LaMotte et al. 1999). Otoliths were removed from returning jacks during 2001 and a proportion of otoliths from return adults during 2002-2006. Unfed fry releases during previous years have only occurred during February. With the ability of Spring Creek NFH to artificially warm water to accelerate egg development, unfed fry are now released during mid-December. The effect of this change in release timing is unknown but potentially poor because of low productivity during this time in the Columbia River for salmon forage species.

The objectives of the study are:
1). Mark up to three million unfed fry (100% of release) and verify the mark from 1999 through 2001.
2). Monitor adult returns to the hatchery for the presence of otolith marks – 2001 through 2006.

3). Write Final Report 2006-2007.

12.2) Cooperating and funding agencies.

Corps of Engineers (funding)
National Marine Fisheries Service (funding)
US Fish and Wildlife Service (cooperating)
Washington Department of Fish and Wildlife (cooperating)

12.3) Principle investigator or project supervisor and staff.

Project Supervisor: Ed Lamotte
Staff: Spring Creek Hatchery Personnel, Columbia River Fisheries Program Office Personnel.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

See Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Broodstock of unfed fry releases are captured as adults swim into hatchery (see Section 7 of this document). Dense brands on otoliths of juvenile tule fall Chinook fry are added by performing cyclical temperature shifts of 5ºF. As eyed eggs/alvins incubate in 52ºF water, periodic cold events of 47ºF spring water will be passed through the incubator stacks for eight hour time periods.

12.6) Dates or time period in which research activity occurs.

Late August through early October adults will be collected for broodstock and otoliths will be removed from a proportion of surplus/spawned tule fall Chinook salmon. Otolith marking will occur in November and release will occur in mid-December.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

See Sections 7, 8, 9, and 12 of this document for Broodstock collection, mating, incubation and rearing, and duration of study.

12.8) Expected type and effects of take and potential for injury or mortality.

Unfed fry are raised identically as Spring Creek NFH production tule fall Chinook except for water temperature changes associated with otolith marking. There are no expected types or effects of take and no potential for injury or mortality beyond standard rearing and release practices mentioned in Section 9 and 10 of this document.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

No listed species are used for this research.

12.10) Alternative methods to achieve project objectives.

Presently, there are no other methods considered for meeting project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12a) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

The hatchery component of the Lower Columbia River Fall Chinook ESU are not listed therefore, listed fish will not be adversely affected during the on-hatchery facets of this study.

SECTION 13. ATTACHMENTS AND CITATIONS

Bayer, R.D. 1986. Seabirds near an Oregon estuarine salmon hatchery in 1982 and during the 1983 El Nino. Fish. Bull. 84: 279-286.

Beamesderfer, R.C.P., D.L. Ward, and A.A. Nigro. 1996. Evaluation of the biological basis for a predator control program on northern squawfish (*Ptychocheilus oregonensis*) in the Columbia and Snake rivers. Canadian Journal of Fisheries and Aquatic Sciences 53: 2898-2908.

Beamish, R.J. (ed.). 1995. Climate Change and Northern Fish Populations. National Research Council of Canada. Ottawa, Canada.

Beamish, R.J., B.L. Thomson, and G.A. Mcfarlane. 1992. Spiny Dogfish Predation on Chinook and Coho Salmon and the Potential Effects on Hatchery-Produced Salmon. Transactions of the American Fisheries Society 121: 444-455.

Becker, C.D. 1973. Food and growth parameters of juvenile chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.

Berggren, T. 1999. Updated analysis of PIT tags detected in bird guano on Rice Island. Memo to U.S. Fish and Wildlife Service. Fish Passage Center, Portland, Oregon.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Chapman, D., and K. Witty. 1993. Habitat of weak salmon stocks in the Snake River basin and feasible recovery measures. Report to the Bonneville Power Administration, DOE/BP-99654-1, Portland, Oregon..

CTC (Chinook Technical Committee). 1994. Pacific Salmon Commission, Report TCCHINOOK (94)-1. Vancouver, British Columbia, Canada.

Dawley, E.M., R.D. Ledgerwood, T.H. Blahm, C.W. Sims, J.T. Durkin, R.A. Kirn, A.E. Rankis, G.E. Monan, and F.J. Ossiander. 1986. Migrational characteristics, biological observations, and relative survival of juvenile salmonids entering the Columbia River estuary, 1966-1983. 1985 Final Report. Bonneville Power Administration and National Marine Fisheries Service, Portland, Oregon.

Dawley, E.M., and B.P. Schrank. 1995. Evaluation of the effects of dissolved gas supersaturation of fish and invertebrates in river reaches near Bonneville, Ice Harbor, and Preist Rapids Dams, 1995. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division. Report to U.S. Army Corps of Engineers, Portland District, Delivery Order E969940029.

DeHart, M. 1995. Summary of the 19995 spirng and summer juvenile passage season Memorandum dated October 9,1995, to Members Liaison Group and Fish Passage Advisory Committee. 32 pp.

Emlen, J.M., R.R. Reisenbichler, A.M. McGie, and T.E. Nickelson. 1990. Density-dependence at sea for coho salmon (*Oncorhynchus kisutch*). Can. J. Fish. Aquat. Sci. 47: 1765-1772.

Enhancement Planning Team. 1986. Salmon and steelhead enhancement plan for the Washington and Columbia River conservation area. Vol. 1. Preliminary review draft.

Goede, R. 1986. Management considerations in stocking of diseased or carrier fish. Pages 349-356 *in* R.H. Stroud, editor. Fish Culture in fisheries management. American Fisheries Society, Bethesda, Maryland.

Goede, R.W. and Barton, B.A. 1990. Organismic indices and an autopsy-based assessment as indicators of health and condition of fish. American Fisheries Society Symposium. 8:93-108.

Groot, C. and L. Margolis. 1991. Pacific salmon life histories. UBC Press, University of British Columbia, Vancouver B.C.

Harlan, K. 1999. Washington Columbia River and tributary stream survey sampling results, 1998. Columbia River Progress Report 99-15. Washington Department of Fish and Wildlife, Vancouver, Washington

IHOT (Integrated Hatchery Operations Team). 1995. Policy and procedures for Columbia Basin anadromous salmonid hatcheries. Annual report 1994 to the Bonneville Power Administration, Portland Oregon. Project # 92-043.

Isaak, D.J., and T.C. Bjornn. 1996. Movement of northern squawfish in the tailrace of a lower Snake River dam relative to the migration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 125: 780-793.

LaMotte, E., D. Tiffan, D. Wills, and W. Talo. 1999. Spring Creek National Fish Hatchery unfed fry evaluation study proposal. US Fish and Wildlife Service Columbia River Fisheries Program Office, Vancouver, WA. 6pp.

Mantua, N.J., S.R. Hare, Y. Zhang, J.M. Wallace, and R.C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bull. Am. Meterol. Soc. 78: 1069- 1079.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Muir, W.D., and R.L. Emmett. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.

Muir, W.D., A.E. Giorgi, and T.C. Coley. 1994. Behavioral and Physiological Changes in Yearling Chinook Salmon During Hatchery Residence and Downstream Migration. Aquaculture 127: 69-82.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-35, 443 p.

Nehlsen, W., J.E. Williams and J.A. Lichatowich. 1991. Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washinton. Fisheries. Vol.16, No. 2:4-21.

NMFS (National Marine Fisheries Service). 1999a. Biological Assessment for Mitchell Act Hatchery Operations. Hatcheries and Inland Fisheries Branch, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1999b. Biological Opinion on Artificial Propagation in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

NMFS (National Marine Fisheries Service). 1999c. Biological Opinion on Harvest in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

NMFS (National Marine Fisheries Service). 1997. Investigation of Scientific Information on the Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-28, 172 p.

Olla, B.L., M.W. Davis and C.H. Ryer. 1993. Behavioral deficits of hatchery-reared Pacific salmon: potential effects on survival following release, p. 19. *In* D.S. Danielssen and E. Moksness [ed.] Proc. Int. Symp. on Sea Ranching of Cod and Other Marine Animals, held in Bergen, Norway, June 15-18, 1993. Institute of Marine Research, Bergen, Norway.

ODFW (Oregon Department of Fish and Wildlife). 2001. Fisheries Management and Evaluation Plan, Lower Columbia River Chinook in Oregon Freshwater Fisheries of the Lower Columbia River Mainstem and Tributaries between the Pacific Ocean and Hood River. http://www.nwr.noaa.gov/1fmep/fmepsbmt.htm

Park, D.L. 1993. Effects of marine mammals on Columbia River salmon listed under the Endangered Species Act, DOE/BP-99654-3. Bonneville Power Administration. Portland, Oregon.

Pastor, S.M. 2000. Annual coded wire program. Annual report 2000 to the Bonneville Power Administration, project 89-065, U.S. Fish and Wildlife Service, Vancouver, Washington.

Pastor, Stephen M. August 2002. Columbia River Information System (CRiS) Database Manager. US Fish and Wildlife Service, Columbia River Fisheries Program Office 9317 Hwy 99, Suite I, Vancouver, WA 98665. stephen_pastor@fws.gov

Piggins, D.J., and C.P.R. Mills. 1985. Comparative aspects of the biology of naturally-produced and hatchery-reared Atlantic salmon smolts *Salmo salar*. Aquaculture 45: 321-334.

Roby, D. et al. 1997. Avian predation on juvenile salmonids in the lower Columbia River. 1997 Annual Report submitted to Bonneville Power Administration and U.S. Army Corps of Engineers.

Ruggerone, G.T. 1986. Consumption of migrating juvenile salmonids by gull foraging below a Columbia River dam. Trans. Am. Fish. Soc. 115: 736-742.

Sager, P.M., and G.J. Glova. 1988. Diet feeding periodicity, daily ration and prey selection of a riverine population of juvenile chinook salmon, *Oncorhynchus tshawytscha*. J. Fish Biol. 33: 643-653.

Salmon Disease Control Policy of the Fisheries Co-Managers of Washington State. March 17, 1998. Northwest Indian Fisheries Commission and Washington Department of Fish and Wildlife, Olympia, WA.

Sharp, B., D. Anderson, G. King, J. Feen, S. McCorqudale, J. Byrne, D. Johnson, T. Strong, J. Hubble, B. Watson, and W. Conley. 2000. Klickitat Subbasin Summary – Draft. Columbia Basin Fish and Wildlife Authority, 87 pp.

Simenstad, C., K. Fresh, and E. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific Salmon: an unappreciated function. Pages 343-364 *in* V. Kennedy, editor. Estuarine comparisons. Academic Press, New York.

Steward, R., and T. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Report 90-1. Part 2 *in* W.H. Miller, editor. Analysis of Salmon and Steelhead Supplementation. Bonneville Power Administration, Portland, Oregon. U.S. Fish and Wildlife, Dworshak Fisheries Assistance Office, Idaho.

STT (Salmon Technical Team). 1999. Preseason report III. Analyses of council adopted management measures for 1999 ocean salmon fisheries. Pacific Fishery Management Council, Portland, Oregon.

SWIG (Species Interaction Work Group). 1984. Evaluation of potential interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel chairman and K. Fresh editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Department of Fish and Wildlife Olympia, Washington. 80pp.

Talo, Wayne. 1999. An overview of the recent history of the Spring Creek National Fish Hatchery. In files at Spring Creek National Fish Hatchery and at Lower Columbia River Fish Health Center.

Toner, M.A. and E.M. Dawley. 1995. Evaluation of the effects of dissolved gas supersaturation of fish and invertebrates downstream from Bonneville Dam, 1993. National Marine Fisheries Sevice, Northwest fisheries Science Center, Coastal Zone and Estuarine Studies Division. Report to U.S. Army Corps of Engineers, Contract E96930036. 33pp. plus appendix.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological Assessments for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service under cover letter, dated August 2, 1994, from Bill Shake Acting USFWS Regional Director to Brian Brown, NMFS.

USFWS Fish Health Policy and Implementation, 713 FW. February 15, 1995. U.S. Fish and Wildlife Service

USFWS. 2001. Gas Supersaturation Monitoring Report for Spill Below Bonneville Dam. Columbia River Fisheries Program Office Vancouver, WA. 12 pp.

Volk E.C., S.L. Schroder and K.L. Fresh. 1990. Inducement of Unique Otolith Banding Patterns as a Practical Means To Mass-Mark Juvenile Pacific Salmon. American Fisheries Society Symposium 7:203-215.

WDW (Washington Department of Wildlife), Confederated Tribes and Bands of the Yakima Indian Nation and Washington Department of Fisheries. 1990. White Salmon River Subbasin. Salmon and Steelhead Production Plan. Bonneville Power Administration, Portland, OR.

Attachment I.
State of Oregon
Department of Environmental Quality
Total Dissolved Gas (Criteria Modification) Petition Contents

1. Definition of Agency Requesting Modification.

The U.S. Fish and Wildlife Service (FWS) is an agency of the Federal Government responsible for the conservation of the nation's natural resources. The Spring Creek National Fish Hatchery (NFH) is charged with producing fish as mitigation for man caused losses due to federal water projects as called for in the Mitchell Act (52 Stat. 345) as amended (60 Stat. 932). Specifically, Spring Creek NFH is responsible for producing 50 percent of the fish required to mitigate the losses of anadromous fish caused by the construction and operation of The Dalles and John Day dams and reservoirs (U.S. Army Corps of Engineers (COE), 1969).

2. Proposed Total Dissolved Gas (TDG) criterion.

The present TDG criterion for the Columbia River downstream of Bonneville Dam is 110% saturation. The FWS proposes that the water quality criterion for TDG be modified to allow for 115% TDG at the Camas-Washougal monitoring site which would be equivalent to a 120% TDG level in the Bonneville Dam Tailrace in March of 2002. This will allow for a spill operation at Bonneville Dam to provide improved passage conditions for the release of 7.5 million juvenile fall chinook salmon from Spring Creek NFH. Physical monitoring at several sites below Bonneville Dam in the mainstem Columbia River will be conducted to provide information and real-time modifications to the proposed operation if the requested variance in criteria is exceeded. This proposed TDG criterion modification is consistent with the TDG level specified by the National Marine Fisheries Service (NMFS) for the Camas-Washougal site in its March 2, 1995, Endangered Species Act (ESA) Section 7 consultation biological opinion for the operation of the Federal Columbia River Power System (National Marine Fisheries Service, 1995). Justification for that modification of the TDG standard is provided in the National Marine Fisheries Service's biological opinion.

Fisheries agencies have requested spill at Bonneville Dam for Spring Creek NFH releases since 1985. Spill was first requested because of the low fish guidance efficiency at the Bonneville Dam Second Powerhouse. Until 1995, spill was usually provided at Bonneville Dam for the March release of chinook salmon. In 1995, the requested total dissolved gas criteria waiver for the Spring Creek NFH fish spill was denied. In part, this request was denied because no biological monitoring was included in the proposal. In 1996 and 1997, the biological monitoring program was included and the dissolved gas waiver request was approved. In 1998 the request for spill waiver was again made, which included biological monitoring, as was in the case in the previous two years. However, the 1998 waiver request was denied. The basis for this denial is unclear, due to the fact that all criteria were met in regards to the TDG spill waiver request. In 1999, 2000, and 2001 the request for spill was proposed and approved. The FWS wants to take this opportunity to again point out the importance of the Spring Creek stock of chinook salmon to the economic benefit to the fishery and the conservation of this stock for future generations.

Past monitoring by National Marine Fisheries Service staff has shown that migratory salmonids, resident fish, and invertebrates have not been significantly affected by TDG levels that are expected during the proposed spill. (Toner and Dawley, 1995; Dawley and Schrank, 1995; DeHart, 1995).

3. Location and timing for application of proposed criterion.

The proposed spill at Bonneville Dam will coincide with the release of the fish from Spring Creek NFH, currently targeted for March 14, 2002. The spill would be scheduled to start at 8:00 p.m. on a day between March 7, 2002 to March 15, 2002 and continue for 10 days (through 8:00 p.m. on March 17 to March 25). The reason for asking for a range of dates at this time is due the early submission of this request and the possibility of an earlier release date due to better growing conditions for the fish. If necessary, spill will be managed during the daytime hours not to exceed a 75 thousand cubic feet per second (kcfs) spill cap. This cap has been used to limit migration delay and fall back of adult salmonids. Nighttime spill levels should attempt to achieve an 80% Fish Passage Efficiency (FPE). According to the NMFS spill calculations, spill levels to achieve 80% FPE at river flows of 200 kcfs would require 10 to 60 kcfs spill above the upper range of spill levels the U.S. Army Corps of Engineers (USACE) has indicated would result in 115% to 120% TDG, respectively, in the tailrace (USACE, Waterways Experimental Station (WES) under DGAS study in 1996-1997). New criteria are being developed by USACE and will be available for future survival calculations.

4. Statement of need for the proposed criterion.

It is very important that we do all we can to provide protection at Bonneville Dam for these fish. Although Spring Creek NFH chinook salmon are not listed under the ESA, the 7.5 million fish that are to be released make up a large portion of the fish to be caught under United States/Canada treaty allocations. These fish are also very important to near shore fisheries off the Washington and northern Oregon coast and local fisheries in the Columbia River. The FWS estimates that the adult contribution from this early release has historically been 1.1 percent which when applied to the number to be released, translates into a potential contribution of 82,500 adult fish.

Spring Creek NFH stock provides protection to the listed Snake River populations and other stocks of chinook salmon, because the Canadian ocean fisheries are managed under harvest quota, time, and area regulations. Both Spring Creek NFH and endangered Snake River stocks of salmon occur off the west coast of Vancouver Island. Greater numbers of Spring Creek NFH fish in the total number of fish in the United States/Canada treaty fishery area would result in fewer Snake River fish being caught. Other chinook salmon stocks, including listed Snake River fish will be exposed to higher harvest rates in Canadian fisheries if the productivity of Spring Creek NFH stock is reduced. Historically, Spring Creek NFH fish contributed to 9% of the catch in the fishery off the west coast of Vancouver Island and 27% of the catch off of the Washington and northern Oregon coasts. Spring Creek NFH has contributed as many as 65,600 fish to treaty Indian fisheries and 41,500 fish to non-treaty commercial fisheries in the Columbia River in the past (PFMC, 1995). In the 2001 fall season treaty Indian fisheries above Bonneville Dam, catch of Spring Creek NFH origin fall chinook was over 52,000 (preliminary numbers).

The fish hatchery program for the Columbia River has been reduced due to a Congressional reduction in Mitchell Act funding. These funding cuts have resulted in reduced production of chinook salmon at both state and federal fish hatcheries and have caused the closure of some facilities. Spring Creek NFH, which will be the only facility producing tule fall chinook above Bonneville Dam, will remain open and continue to produce fish at its present levels. The state of Oregon has drastically reduced its production of tule fall chinook salmon in the Columbia River system. These reductions and closures at other hatcheries make production at Spring Creek NFH even more important for maintaining and improving fisheries in the Pacific Ocean and Columbia River.

The Fish and Wildlife Service's Biological Assessment for 1995 Hatchery Operations (USFWS, 1995) includes Spring Creek NFH and includes the same operations as in past Biological Opinions that provided improved passage for this release.

5. Rationale for the derivation of proposed criteria.

Past TDG monitoring data indicate that an 80% fish passage efficiency (FPE) level is not achievable through spill at Bonneville Dam without exceeding the Water Quality Agencies' 110% total dissolved gas (TDG) standard in the tailrace. In an attempt to maximize passage survival while minimizing the risk of potential adverse effects of TDG, we recommend spill levels that result in an average 115% TDG calculated from the 12 highest hourly measurements at the Camas-Washougal monitoring site. The Camas-Washougal monitoring site has previously been used as a primary location for monitoring TDG downstream from Bonneville Dam. A 115% TDG level at the Camas-Washougal site would be equivalent to a 120% TDG level in the Bonneville Dam tailrace. This cap should assure that maximum TDG levels in the Bonneville Dam spill basin are at or below 125% TDG. This recommendation is based on the scientific information available which indicates that spill is by far the safest route of passage (Holmes 1952; Ledgerwood et al. 1990; Shoeneman et al. 1961; Iwamoto, et al. 1994) and that these fish will have a limited exposure time to elevated gas conditions downstream from Bonneville Dam.

Table 1 displays a possible flow scenario with different volumes of spill, associated total dissolved gas levels in the Bonneville Dam tailrace, fish passage efficiency, and increase in fish survival compared to the "no spill" condition with 7.5 million fish released from Spring Creek NFH. The Bonneville Dam forebay TDG was assumed to be 100%.

Table 1. Bonneville Dam Spillway Flows, Total Dissolved Gas Levels in Tailrace, Fish Passage Efficiency, and Increase in Fish Survival Past Bonneville Dam.

Total River Flow (kcfs)	200	200	200	200	200	200
Spill (kcfs)	0	45	80	100	120	150
Tailrace Gas Level (%)	100	110	114	116	117	120
Fish Passage Efficiency (%)	33	48	59	63	66	71
Increase in Fish Survival Compared to No Spill Condition	0	133,500	229,500	258,750	288,750	333,000

Spill that produces 120% saturation in the tailrace would increase survival by approximately 4.9% or about 333,000 fish over the no spill condition during passage at Bonneville Dam. In 1993 and 1994 the National Marine Fisheries Service examined resident and migratory species present in the river below Bonneville Dam when moderate spill was occurring. In 1993, GBD signs were noted in 0.1% (2 of 1,657) juvenile chinook salmon examined (Toner and Dawley, 1995). The few signs that were observed occurred when TDG levels exceeded 120% at the sampling site 15 miles below the dam. Maximum levels reached 125% at that time. In 1994, signs of GBD were noted in 0.2% (3 of 1227) juvenile chinook salmon examined (Toner, et al., 1995). Nearly all these occurred when one day TDG levels were up to 117% in the study area (TDG levels were as high on other days with no signs noted).

Information obtained from the 1995 gas bubble trauma sampling program indicates that migrating juvenile salmon did not experience exposure to TDG levels that caused significant mortality to these fish (McCann, 1995). Less than 1% of all migrating salmon that were sampled during the 1995 migration period of April 15 to July 1 showed signs of GBD. Of those fish that exhibited signs of GBD, none showed above the lowest severity ranking criterion and most fish showing signs had only a few bubbles in a single fin.

Biological monitoring conducted during the March 13 to 23, 1997, TDG waiver period showed that none of the 990 juvenile chinook salmon that were examined exhibited external signs of GBD. It should be noted that TDG levels were higher than the 115% TDG allowed by the waiver during this time because of high river flow and forced spill conditions. Monitoring conducted during the TDG waiver period in 1998, 1999 and 2000 also showed no signs of GBD in any of the samples examined.

In 2001, 3 of the sample fish (two hatchery fall chinook and one northern pikeminnow) showed the lowest detectable level of GBD, one small bubble in the lateral line or a fin. These fish represented 1.4% of the sample, far below the 15% limit in the 2001 waiver. A low level of incidence can be found in non-spill situations. The low incidence found in 2001 does not suggest a significant level of GBD in the population at large (J. McCann, Fish Passage Center, personal communication).

Loss to the effects of dissolved gas would also be expected to be quite low because of limited exposure time. Exposure to the higher TDG levels is limited primarily by the travel time of these fish from Bonneville Dam downstream to the confluence of the Columbia River with the Willamette River. Blahm (1974) measured an approximate 10% decrease in dissolved gas between the Bonneville Dam spillway (river mile 141) and the Willamette confluence (river mile 101-103). From Dawley et al. (1984) we know that the median travel time for a March release of fish at Spring Creek NFH to Jones Beach is about 17 days, for a travel rate of about seven miles per day. If this travel rate is applied to the 40 miles between Bonneville and the Willamette River, outmigrating tule fall chinook salmon released from Spring Creek NFH will be exposed to elevated TDG for about six days. Blahm (1974) found that subyearling (70mm) chinook salmon held in 2.5-meter-deep tanks for prolonged exposure (50 days) to 120% TDG experienced very low mortality (three out of 112 fish). Many other past research projects support this finding (CBFWA 1995). We anticipate that these early Spring Creek NFH migrants will be traveling in water at least as deep as these tanks.

Based on these studies and additional information that indicates that each meter of depth provides pressure compensation equal to a 10% reduction in TDG, that juvenile salmon tend to spend most of their time at or below 1 meter of depth, and that deep tank tests showed that salmonids exposed to 115% did not experience significant mortality until exposure time exceeded 60 days, the National Marine Fisheries Service concluded that it was appropriate to seek an operation that would result in exceeding 110% TDG saturation (NMFS, 1995a).

While sublethal effects of TDG are possible, we have no evidence leading us to believe that these effects would cause significant mortality of chinook salmon from this hatchery release or of other species, particularly given the short duration of spill and the relatively low level of resultant gas supersaturation. The Spill and 1995 Risk Management document (CBFWA, 1995) discussed past research on sublethal effects of high TDG levels and indicated that swimming performance, growth and blood chemistry are affected, but that sources of indirect mortality have never been formally documented. Transition from freshwater to saltwater was found not to be affected in juvenile salmonids that survived tests at high TDG levels. Smolts exhibiting symptoms of gas bubble disease were also reported to be no more vulnerable to predation by northern squawfish than smolts that were not exposed to higher levels of TDG.

Based on observations from 1993 through 2001, it appears that resident fish and invertebrates can tolerate moderately high levels of TDG for several weeks. Impacts on resident fish and invertebrates are discussed in greater detail under Item 6 of this petition. The operation will last only for 10 days and will end. Water quality criteria will then revert to the state standards of 110% TDG.

<u>Alternative Actions Considered</u>

The FWS has considered alternatives to spill to increase the number of Spring Creek NFH fish that pass Bonneville Dam. These alternatives include transporting juvenile fall chinook salmon and releasing more fish.

<u>Transporting Juvenile Fish</u>

The alternative of physically transporting juvenile fish from Spring Creek NFH and releasing them downstream from Bonneville Dam has been considered. This alternative offers the potential to reduce the mortality associated with passage at Bonneville Dam caused by turbines, fish bypass devices, sluiceways, and predation in powerhouse tailraces. Transporting fall chinook salmon directly from Spring Creek NFH by barge to a release site below Bonneville Dam has been studied (Slatick et al. 1984). A very high percentage of the adult returns from the barged groups strayed to other hatcheries. In addition, return rates to Spring Creek NFH were significantly lower for the barge test groups than for the control group released at the hatchery.

A return of 7,000 adult fish to Spring Creek NFH is the goal to provide enough fish for spawning purposes. Straying of fish to locations other than Spring Creek NFH may result in failure to meet this return goal.

Historically, Spring Creek NFH has been the major producer of tule fall chinook salmon in the Columbia River (Washington Department of Fisheries, 1986). The Spring Creek NFH stock originated from native brood stock collected from the Big White Salmon River and has developed over many generations without major transfers of other stocks of fish into its program. The Washington Department of Fisheries, Oregon Department of Fish and Wildlife, Columbia River Inter-tribal Fish Commission, and the Fish and Wildlife Service reached consensus in 1985 that Spring Creek fall chinook salmon are a unique group of fish and that transfers of fish from other lower Columbia River hatcheries would jeopardize their genetic integrity.

The unique qualities exhibited by Spring Creek chinook salmon are displayed in their age at maturity, ocean distribution, and survival. Spring Creek NFH fish usually mature at an earlier age than other lower Columbia River stocks; 66% of the fish returning to Spring Creek are 3-year-old fish compared to 45% 3-year-olds for other hatcheries. Overall survival and contribution to fisheries has generally been higher for Spring Creek fish compared to other hatcheries. Although it might be possible to use surplus fish from other nearby hatcheries for spawning purposes, we would not know if fish from other hatcheries would actually be of Spring Creek NFH origin. The unknown origin of fish that would return to other hatcheries would make use of those fish an uncertain proposition. It is also possible that other hatcheries would not have surplus fish available to Spring Creek NFH for spawning purposes. The FWS does not believe that it would be advisable to transfer fish from other hatcheries in the event that adult fish returns are insufficient because of the desire to protect the genetic integrity of this stock. As a result of the Slatick et al. (1984) study and similar studies of direct transport from hatcheries and the desire to protect the genetic integrity of Spring Creek NFH stock, we do not support direct transport of fish from Spring Creek NFH as an alternative to providing good passage conditions at Bonneville Dam.

<u>Releasing Additional Fish</u>

The FWS evaluated the possibility of raising and releasing additional fish to make up for those that would be lost to turbines or other causes during passage at Bonneville Dam in the absence of spill. Spring Creek normally produces the maximum number of fish possible under existing hatchery capacity. Fish are released in March, April, and May under a schedule that produces the maximum number of fish for the available rearing capacity of the hatchery. Under this release schedule, some of the hatchery's fish are released in March and normally the remaining fish grow to occupy the rearing space that becomes available. Fish that remain after the April release likewise grow to occupy rearing space until their release. It would not be possible to raise additional fish because rearing space, water supply, and waste treatment capability are limited. It would also not be feasible to release fish at a later date because of limited hatchery capacity since these fish would continue to grow and exceed hatchery space capacity.

At present Spring Creek NFH is expecting a normal return of 7,000 adults and to be at one hundred percent (100%) production in 2002. Historically, the March release of juvenile fish has produced the most returning adults because more fish have been released. The percent returns from the three releases have been comparable, although the month which produces the highest percent return has varied from year to year. The FWS has scheduled releases of juvenile fall chinook in March, April, and May to reduce the risk of a lower return from a single month's release.

<u>Competition between Spring Creek NFH Fish and Snake River Salmon</u>

Competition between fish released from Spring Creek NFH in March and listed stocks of Snake River salmon is expected to be minimal in both the Columbia River and Pacific Ocean. The distance between Spring Creek NFH and the ocean is relatively short and fish releases either completely miss or only slightly overlap the migrations of Snake River fish (USFWS, 1995). Spring Creek NFH fish are also physiologically ready to migrate and should quickly move out of rearing areas in the lower Columbia River. It is possible that Spring Creek NFH fish could compete with Snake River listed stocks for food and space in the ocean. Coded wire tag recoveries of Spring Creek NFH tule fall chinook salmon and Snake River Lyons Ferry Hatchery fall chinook salmon indicate that both stocks of fish migrate north after leaving the Columbia River. However, the FWS has concluded that the size of the ocean environment and the fact that billions of salmonid smolts migrate to the ocean throughout the range of anadromous fish make it seem that direct interaction between Spring Creek NFH fall chinook and Snake River listed salmon stocks would be a remote possibility (USFWS, 1995).

6. Documentation of findings (I) through (IV)

The Environmental Quality Commission must make four findings as identified in the following rules I through IV as listed below. These are:

I) Failure to act would result in greater harm to salmonid stock survival through in-river migration than would occur by increased spill;
II) the modified total dissolved gas criteria associated with the increased spill provides a reasonable balance of risk of impairment due to elevated total dissolved gas to both resident biological communities and to migrating adult and juvenile salmonids, and to other migrating fish when compared to other options or in-river migration of salmon;
III) adequate data will exist to determine compliance with the standards; and
IV) biological monitoring is occurring to document that the migratory salmonid and resident biological communities are being protected.

The FWS addresses the required findings in the following discussion.

I) The FWS believes that greater harm would result to Spring Creek NFH stock through in-river migration than would occur by increased spill because more fish would pass through turbine units at Bonneville Dam. Passage through turbine units at Bonneville Dam is known to cause greater mortality to downstream migrating juvenile salmonids than passage via spill. Holmes, 1952, found that turbine mortality at the Bonneville Dam first powerhouse ranged between 11 and 15%. Holmes estimated spill mortality to be considerably lower at about 2%. Schoneman et al., 1961, found similar mortality percentages at low head Kaplan turbines. Ledgerwood et al., 1990, found that fish passing Bonneville Dam via the spillway had a significantly higher recovery percentage at Jones Beach (head of the Columbia River Estuary) than fish which passed through the Bonneville Dam Second Powerhouse turbines or the fish bypass system. Additional studies have shown turbine mortalities between 8 and 32% compared to 0 to 4% for spillway passage (CBFWA, 1995). Elimination or reduction of spill would subject downstream migrants to higher mortality in the turbines, bypass systems, or tailrace areas.

Failure to adopt the proposed TDG criteria will result in greater harm to salmon survival because more fish would pass through turbine units at Bonneville Dam. This would result in greater mortality as described in section 5 above.

II) The FWS believes that the modified total dissolved gas criteria associated with the increased spill will reasonably balance the risk of impairment due to elevated total dissolved gas to both resident biological communities and to migrating adult and juvenile salmonids, as well as to other migrating fish when compared to other options for in-river migration of salmon.

<u>Impacts to Resident Fish and Invertebrates</u>

The TDG levels resulting from the requested spill are not expected to have a great impact on resident fish or macro invertebrates in the Columbia River downstream from Bonneville Dam. The National Marine Fisheries Service monitored resident fishes and aquatic invertebrates in the Columbia River downstream from Bonneville Dam for signs of gas bubble trauma in 1993, 1994, 1995, and 1996. Organisms sampled included squawfish, bass, perch, catfish, crappie, sturgeon, shad, suckers, chub, sculpins, sticklebacks, minnows, crayfish and other crustaceans, clams, snails, and insects. Sampling in 1993 revealed a very low incidence of GBD in prickly sculpin (0.6%; 1 of 174 fish); peamouth chub, (0.4%; 1 of 238 fish); and threespine stickleback (0.2%; 2 of 906 fish). No signs of GBD were seen in the three species of invertebrates (crayfish, Asian clam, and dragonfly larvae) that were examined (Toner and Dawley, 1995). In 1994, no signs of GBD were observed in any of the 4,955 resident fish or 3,928 invertebrates that were examined (Toner, et al., 1995). During 1995, signs of GBD were noted in 5 species of resident fish, but never exceeded 1% of those fish examined (Dawley and Schrank, 1995).

In 1997, resident fish were collected and examined for the TDG monitoring program. Fish that were examined included peamouth, largescale sucker, mountain whitefish, northern squawfish, stickleback, redside shiner, sculpin, sandroller, pumpkinseed, and carp. A total of 214 individual fish of these resident species were examined for external signs of GBD. No signs of GBD were seen on any of those fish.

In 1998, only largescale suckers and mountain whitefish were examined. No signs of GBD were observed in these fish. In 1999, largescale sucker, northern pike minnow, stickleback and sculpin were examined. Again, no signs of GBD were observed.

In addition, many of these resident species occupy shallow near shore areas that are out of the main current of the Columbia River. Such areas typically have lower total dissolved gas concentrations than those in the main current. Toner et al., 1995, indicated that the lower TDG levels in the shallow backwater and shoreline areas may be due to the lack of exchange with higher TDG water in the main river. Faster dissipation of gas from shallow water was also thought to occur because of its higher surface area to volume ratio.

Impacts to Migrating Adult Salmon

Possible impacts to adult salmon include delay of upstream migration, fallback of fish that have passed Bonneville Dam, and gas bubble disease effects. Spilling would occur for a relatively short period of time when comparatively few adult salmonids are migrating upstream past Bonneville Dam. Cumulative counts of spring chinook passage at Bonneville Dam for March of 1996, 1997, 1998, 1999, 2000, and 2001 were 73, 289, 336, 149, 1,436, and 8,529 fish, respectively. The 10-year average is 592. The 2001 spring chinook return was a record high since the construction of Bonneville Dam. The average total run of spring chinook salmon for the past 10 years is 70,780 fish. While it is possible that some of the spring chinook salmon passing Bonneville Dam during this period may be bound for the Snake River system, these fish may be destined for any of the Columbia River or Snake River tributaries. Horton and Wallace, 1966, found no difference in the timing of spring chinook salmon destined for middle Columbia River tributaries. They also found no distinct, chronological pattern of movement past Bonneville Dam for Snake River spring chinook.

The main period of adult passage at Bonneville Dam is during the day. If necessary, a daytime spill limitation of 75 kcfs can be in effect during the requested waiver period. This spill cap has been put into effect during previous spills at Bonneville Dam to reduce fallback of fish and to ensure that upstream migrating adult salmon are not delayed. Use of the cap can be decided at the time of spill depending on the passage indices of adults.

Adult salmonids were monitored for signs of GBD through the 1999 spill season. Few signs of GBD were observed at the same TDG levels that are proposed for this waiver. Additionally, juveniles are more susceptible to GBD, and if they are being monitored adequately the adults will also be protected (L. Marsh, Oregon Department of Environmental Quality, memorandum to the Environmental Quality Commission, March 27, 2000). Physical handling of adults adds extra stress.

Impacts to Juvenile Salmonids

Spring Creek NFH fish will be released when very few juveniles from other stocks of anadromous fish are migrating. As an example, the average daily passage index counts at Bonneville Dam for yearling chinook, coho, sockeye, and steelhead during the period of the 1995 Spring Creek NFH spill were: yearling chinook, 508 fish; coho, 123 fish; sockeye, 6 fish; and steelhead, 106 fish. Index counts for Spring Creek NFH fish during this time averaged 64,454 fish. Daily index counts at Bonneville Dam during mid-May, a major migration period, in 1995 were: 44,835 yearling chinook; 38,751 coho; 13,110 sockeye; and 18,170 steelhead.

Survival of juvenile salmonids that pass Bonneville Dam via spill compared to those which pass the dam through the powerhouses or fish bypasses is discussed in Item I.

III) The Army Corps of Engineers will be monitoring total dissolved gas levels in the Columbia River at four sites during the proposed spill. These sites will be at the Bonneville Dam forebay, Warrendale, Skamania, and Camas-Washougal. Details of the physical monitoring program will be in the forthcoming Corps of Engineers Plan of Action for Dissolved Gas Monitoring in 2002. That plan will be similar to the Corps of Engineers Plan of Action for Dissolved Gas Monitoring in 2001 (Corps of Engineers, 2001). According to the plan of action, data collection and transmission will start before the release of fish from Spring Creek NFH. Total dissolved gas pressure, water temperature, barometric pressure, dissolved oxygen pressure, and nitrogen + argon pressure data will be collected hourly.

IV) U.S. Fish and Wildlife Service staff will conduct biological monitoring downstream from Bonneville Dam during the proposed spill period. All fish sampled will be examined for GBD. Details of the biological monitoring program are described under Item 9, "Description of biological monitoring." Biological monitoring will include both external and internal examinations of fish. Past monitoring by National Marine Fisheries staff has shown that migratory salmonids, resident fish, and invertebrates have not been significantly affected by TDG levels that are expected during the proposed spill. (Toner and Dawley, 1995; Dawley and Schrank, 1995; DeHart, 1995). It is the opinion of the FWS that the biological monitoring to be conducted will be adequate to protect migratory fish, and invertebrates in the spill affected river reach.

V) Fall chinook and chum salmon have spawned near Ives Island, which is located about two miles downstream from Bonneville Dam. To protect chinook and chum eggs and fry, U.S. Fish and Wildlife Service staff will monitor total dissolved gas and water depth over salmon redds, calculate embryo development, and sample for fry that may have emerged from the gravel. Embryo development will be calculated because eggs are more resistant to high total dissolved gas levels than sac fry. Water depth and total dissolved gas will be monitored on a real time basis. The U.S. Fish and Wildlife Service will contact the Corps of Engineers to reduce spill if biological sampling, water depth readings, or total dissolved gas data indicate that salmon eggs or fry could be adversely affected.

7. Supporting material

<u>Columbia Basin Fish and Wildlife Authority's "Spill and 1995 Risk Management"</u>.

The technical staff of the Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, and Columbia River Inter-Tribal Fish Commission have prepared a report entitled "Spill and 1995 Risk Management." This report discusses the benefits and risks of spill at hydroelectric projects on the mainstem Columbia and Snake rivers. This report concludes that controlled spill at the mainstem hydroelectric projects is integral to protecting salmon resources in the Columbia and Snake rivers. It recommends that water quality criteria for TDG be modified to allow maximum gas concentrations in a range of 120% to 125% based on 12 hour averages.

<u>Fish Passage Survival Estimates</u>

Fish passage survival estimates were derived from a National Marine Fisheries Service "SIMPAS" model for fish passage at Columbia and Snake river dams. The SIMPAS model was developed by National Marine Fisheries Service technical staff and is based on information obtained from numerous fish passage studies at Columbia and Snake river hydroelectric projects.

<u>Fish Harvest Estimates</u>

Chinook salmon harvest was determined by using the Pacific Salmon Council Chinook Technical Committee's Bilateral Chinook Model. This model was developed by the Chinook Technical Committee for use in evaluating the effect of ocean fishing regimes on the rebuilding of chinook salmon stocks. In river harvest estimates are compiled by the Technical Advisory Team.

8. Description of physical monitoring of TDG.

Physical monitoring of TDG will be conducted by staff from the U.S. Geological Survey (USGS) under contract with the Portland District, U.S. Army Corps of Engineers. The USGS is scheduled to begin collecting TDG and other water quality data before the release of fish from Spring Creek NFH. Other water quality data to be collected include water temperature, barometric pressure, dissolved oxygen pressure, and nitrogen + argon pressure. Data will be collected every hour. The proposed monitoring sites will be at Warrendale, Skamania, Camas/Washougal, and the Bonneville Dam forebay. Monitoring will be conducted according to USACE procedures as described in the forthcoming Corps of Engineers Plan of Action for Dissolved Gas Monitoring in 2002. Hourly water quality data will be available on the Corps of Engineers' Internet World Wide Web pages for total dissolved gas. Information available will include the date and time of tensionometer probe readings, water temperature, total dissolved gas pressure, calculated TDG saturation, project hourly spill, project total hourly outflow, and number of spillway gates open. The percent TDG will be calculated from the barometric and TDG gas pressures.

9. Description of biological monitoring of TDG.

The U.S. Fish and Wildlife Service will conduct the biological monitoring of fish collected in 2002. Field crews from the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife will use seines to collect fish samples. Sample fish will be examined for signs of GBD for two days during the proposed waiver period. In light of the overwhelming evidence of past years monitoring, little or no deleterious effects are expected during the proposed waiver period.

In 1995, National Biological Service researchers studied various indicators of GBD to determine their sensitivity and consistency. These included examinations of paired and unpaired fins, lateral lines, and gill lamellae. Examinations were conducted after exposure of fish to TDG levels of 112, 120, and 130%. Results of these tests showed that the caudal fin (tail) was the best indicator of prevalence of GBD at all TDG levels tested and that fins showed the progressive change in severity of GBD. The lateral line showed the progressive change of GBD, especially at higher TDG levels, showed low variability between individual fish, and was a commonly seen sign of GBD. Gill examinations produced highly variable results, showed little progressive change, and were moderately prevalent in occurrence (Mesa, 1995). As a result of these tests the overall fish monitoring program for 2001 will not include examinations of gill lamellae at all sampling stations, but will include more limited numbers of gill examinations on an experimental basis for comparison with those from standard external examinations. Another consideration is the potential increase in mortality or injury to fish that would be subjected to additional handling involved in gill examinations. The Fish Passage Center estimates that gill examinations would require 2 to 3 minutes to conduct and would double the handling time required for a total examination of each fish (McCann, 1995). For these reasons, the FWS does not propose that gill lamellae examinations be included in the biological monitoring program for the Spring Creek NFH spill at Bonneville Dam.

Adult Salmonids

Adult salmonids were monitored for signs of GBD through the 1999 spill season. Few signs of GBD were observed at the same TDG levels that are proposed for this waiver. Additionally, juveniles are more susceptible to GBD, and if they are being monitored adequately the adults will also be protected (L. Marsh, Oregon Department of Environmental Quality, memorandum to the Environmental Quality Commission, March 27, 2000). The FWS does not propose that adult salmonids be collected and examined because of the stress involved in handling these fish, because of the endangered status of some of the fish that might be collected, and because of past monitoring that found a very low incidence of GBD in adult fish.

10. Availability of Documents.

Documents cited in this petition are available at the Fish and Wildlife Service's Columbia River Fisheries Program Office at 9317 Highway 99, Suite I, Vancouver, Washington 98665.

Blahm, T.H. 1974. Report to COE Gas Supersaturation Research Prescott Facility 1974 NMFS CZES report, 20 p. plus appendices.

Columbia Basin Fish and Wildlife Authority. 1995. Spill and 1995 Risk Management. Report by the Fish Passage Advisory Committee.

Columbia River Compact. 1995. Joint Staff/TAC report, fall fact sheet number 7, October 6, 1995.

Corps of Engineers. 2001. Corps of Engineers Plan of Action for Dissolved Gas Monitoring in 2001. 12p.

DeHart, M. 1995. Summary of the 1995 spring and summer juvenile passage season. Memorandum dated October 9, 1995, to Members Liaison Group and Fish Passage Advisory Committee. 32 p.

Dawley, E.M., R.D. Ledgerwood, T.H. Blahm, R.A. Kirn, A.E. Rankis, and F.J. Ossiander. 1984. Migrational characteristics and survival of juvenile salmonids entering the Columbia River estuary during 1982. Report to the Bonneville Power Administration, Contract DE-AI79-82BP30578. 49 p. plus appendices.

Dawley, E.M., and B.P. Schrank. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates in river reaches near Bonneville, Ice Harbor, and Priest Rapids Dams, 1995. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division. Report to U.S. Army Corps of Engineers, Portland District, Delivery Order E969940029 (Abstract only).

Holmes, H.B. 1952. Loss of fingerlings in passing Bonneville Dam as determined by marking experiments. U.S. Fish and Wildlife Service, Unpublished Manuscript. 62 p.

Horton, H.F., and R.L. Wallace. 1966. Tagged salmon and the Indian fishery, December, 1966. Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon. U.S. Dept. of the Interior, Bureau of Commercial Fisheries and Bureau of Indian Affairs contract no. 14-17-0001-1413. 112 p.

Iwamoto, R.N., W.D. Muir, B.P. Sandford, K.W. McIntyre, D.A. Frost, J.G. Williams, S.G. Smith, and J.R. Skalski. 1994. Survival estimates for the passage of juvenile chinook salmon through Snake River dams and reservoirs, 1993. Annual report to the Bonneville Power Administration, Contract DE-AI79-93BP10891, Project 93-29. 126 p. plus appendices.

Ledgerwood, D.L., E.M. Dawley, L.G. Gilbreath, P.J. Bentley, B.P. Sandford, and M.H. Schiewe. 1990. Relative survival of subyearling chinook salmon which have passed Bonneville Dam via the spillway or the second powerhouse turbines or bypass system in 1989, with comparisons to 1987 and 1988. Report to the U.S. Army Corps of Engineers, Contract E85890097, 62 p. plus appendices.McCann, J. 1995. Results of 1995 GBT juvenile salmon monitoring program and 1996 monitoring protocol. October 18, 1995, memorandum of Gas Bubble Trauma Technical Work Group. 11 p.

Mesa, M. 1995. Presentation to Gas Bubble Disease Technical Work Group, September 14, 1995.

National Marine Fisheries Service. 1995. Endangered Species Act Section 7 consultation biological opinion. Reinitiation of consultation on 1994-1998 operation of the federal Columbia River power system and juvenile transportation program in 1995 and future years. National Marine Fisheries Service, Northwest Region. 166 p.

National Marine Fisheries Service. 2000. Gas bubble disease monitoring plan. 6 p.

National Marine Fisheries Service. 1996. Fish handling and gas bubble disease assessment protocols. For: Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates in the mainstem Columbia and Snake rivers. National Marine Fisheries Service, January 11, 1996. 4 p.

Schoneman, D.E., R.T. Pressey, and C.O. Junge, Jr. 1961. Mortalities of downstream migrant salmon at McNary Dam. Transactions of the American Fisheries Society. 90(1): 58-72.

Slatick, E., L.G. Gilbreath, J.R. Harmon, C.S. McCutcheon, T.C. Bjornn and R. Ringo. 1984. Imprinting salmon and steelhead trout for homing. National Marine Fisheries Service Report to Bonneville Power Administration, September 1984 (Contract DE-AI79-82BP39646). 66 p. plus appendices.

Tanovan, B. 1994. Spill discharge calculations. Memorandum for PE-ER (Turner/Athearn), dated December 7, 1994.

Tanovan, B. 1995. Personal communication. December 4, 1995, telephone conversation with M. Yoshinaka.

Toner, M.A. and E.M. Dawley. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates downstream from Bonneville Dam, 1993. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division. Report to U.S. Army Corps of Engineers, Contract E96930036. 33 p. plus appendix.

Toner, M.A., B. Ryan, and E.M. Dawley. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates downstream from Bonneville, Ice Harbor and Priest Rapids Dams, 1994. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division. Report to U.S. Army Corps of Engineers, North Pacific Division, Contract E96940029. 38 p.

U.S. Army Corps of Engineers, Walla Walla District. 1969. John Day Design Memorandum number 46. Spring Creek National Fish Hatchery.

U.S. Army Corps of Engineers, Portland and Walla Walla Districts. 1994. Dissolved Gas Abatement Interim Letter Report. 28 p.

U.S. Army Corps of Engineers. 2000. Dissolved gas monitoring plan of action. 10 p.

U.S. Fish and Wildlife Service. 1995. Biological assessment for operations covering 1995-1999, U.S. Fish and Wildlife Service, Spring Creek National Fish Hatchery, Skamania County, Washington. 19 p.

Washington Department of Fisheries. 1986. A Perspective on Spring Creek Hatchery’s Tule Fall Chinook Production. March 10, 1986. 8 p.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief."

Name, Title, and Signature of Applicant:

Certified by_______________________________ Date:______________

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2)

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

Currently, Spring Creek NFH is not required to obtain any ESA permits or authorizations for USFWS trust species regarding current projects or operations. In 1997, Spring Creek NFH did consult with US Fish and Wildlife Service personnel regarding a construction project for maintenance and improvements to the hatchery (FWS Reference 1-2-98-SP-0416 and File Name 98ta007.wpd).

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Species	Status	Projected take
Bald Eagle (*Haliaeetus leucocephalus*)	Listed	None
Northern spotted owl (*Strix occidentalis caurina)*	Listed	None
Peregrine Falcon (*Falco peregrinus*)	Listed	None
Bull trout (*Salvelinus confluentus*)	Listed	None
California wolverine (*Gulo gulo luteus*)	Concern	None
Cascades frog (*Rana cascadae*)	Concern	None
Larch Mtn salamander (*Plethodon larselli*)	Concern	None
Long-eared myotis bat (*Myotis evotis*)	Concern	None
Long-legged myotis bat (*Myotis volans*)	Concern	None
Northern goshawk (*Accipiter gentilis*)	Concern	None
Northwestern pond turtle (*Clemmys marmorata marmorata*)	Concern	None
Olive sided flycatcher (*Cantopus cooperi*)	Concern	None
Pacific Townsend's big-eared bat (*Corynorhynus townsendii townsendii)*	Concern	None
Pacific lamprey (*Lampetra tridentata*)	Concern	None
River lamprey (*Lampetra ayresi*)	Concern	None
Tailed frog (*Ascaphus truei*)	Concern	None
Western toad (*Bufo boreas*)	Concern	None
Oregon Spotted Frog (*Rana pretiosa*)	Candidate	None
Northern Red-legged frog (Rana aurora aurora)	Concern	None
Larch Mountain salamanders (Plethodon larselli)	Concern	None
California Mountain Kingsnake (Lampropeltis zonata)	Concern	None
Penstemon barrettiae (Barrett's beardtongue)	Concern	None

Rorippa columbiae (Columbia yellow-cress)	Concern	None
Sisyrinchium sarmentosum (pale blue-eyed grass)	Concern	None

15.3) Analyze effects.

None of the above listed species are likely to be adversely affected by this program. Mitigative management actions were taken during 1997/98 construction improvement for northern red-legged frogs, Larch Mountain salamanders and California mountain kingsnakes. See section 3.5 of this document for detailed information on program effects on aquatic species under NMFS jurisdiction.

15.4 Actions taken to minimize potential effects.

Spring Creek NFH construction improvements carried out during 1997/98 were mitigated by performing the recommendations of USFWS – Oregon State Office (FWS Reference 1-2-98-SP-0416 and File Name 98ta007.wpd, Todd 1997).

15.5 References

Todd, Laura. 1997. Management plan fro northern red-legged frogs (Rana aurora aurora), Larch Mountain salamanders (Plethodon larselli), and California mountain kingsnake (Lampropeltis zonata) at Spring Creek National Fish Hatchery Underwood, Washington. Fax transmission from, Garry S. Miller, Acting State Supervisor US Fish and Wildlife Service, Oregon State Office to Ed Lamotte, Hatchery Manager, Spring Creek National Fish Hatchery, November 13, 1997. 6 pp.